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SYSTRON DONNER

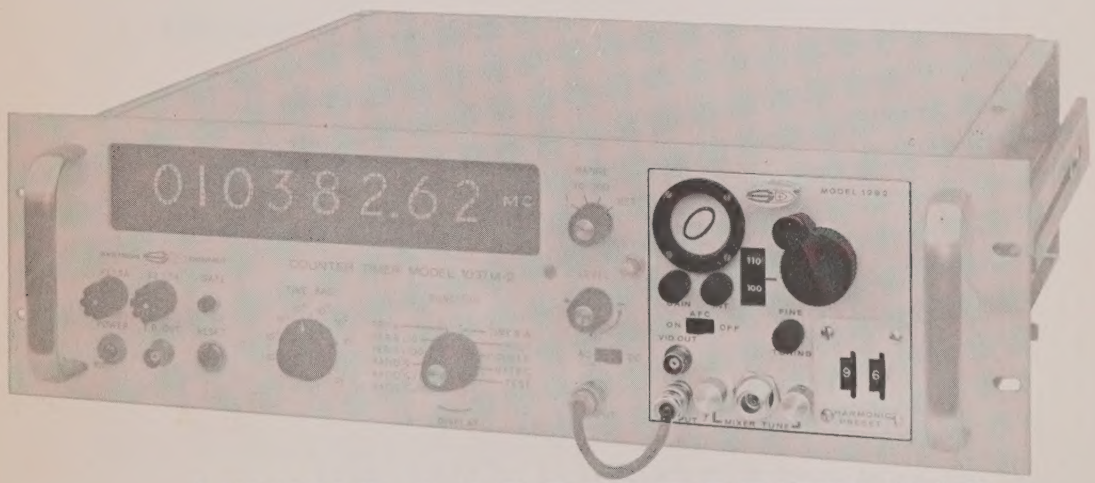
1017

Serial No.

Date

MODELS 1292, 1292-1

TRANSFER OSCILLATOR



VIKING LABORATORIES INC.

CAUTION!

1. Do not remove Plug-in Units with power on.
2. When Model 1292-1 Plug-in is installed, leave Harmonic Preset Switches at 0-0 at all times except as directed.
3. Make sure intensity on scope is at a low level.

SYSTRON DONNER CORPORATION

1292

CONCORD, CALIFORNIA

825-9810

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APPENDED SCHEMATICS — Drawing No.

Block Diagram 15192

Oscillator Amplifier, Pre-Scaler 14871

Harmonic Pre-Set 14872

Time Base Scale-of-Three 14873

Video Amplifier, Discriminator, H. V. Power Supply, Regulator and Harmonic Generator/Mixer 14875

Centering Circuit 14877

WARRANTY

Systron-Donner instruments are warranted during a period of one year from date of shipment to original purchaser to be free from defects in material and workmanship. This warranty does not apply to vacuum tubes, except as they are warranted by tube manufacturers. The liability of Seller under this warranty is limited to replacing or repairing any instrument or component thereof which is returned by Buyer at his expense during such period and which has not been subjected to misuse, neglect, improper installations, repair, alteration, or accident. Seller shall have the right of final determination as to the existence and cause of a defect. In no event shall Seller be liable for collateral or consequential damages. This warranty is in lieu of any other warranty, express, implied or statutory, and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

RECEIVING INSPECTION

Every Systron Donner instrument is carefully inspected and is in perfect working order at the time of shipment. Each instrument should be checked as soon as received. If the unit is damaged in any way or fails to operate, a claim should immediately be filed with the transportation company.

REPAIRS

Whenever a Systron-Donner instrument requires service, the nearest Systron-Donner representative should be contacted; all representatives will provide immediate service or arrange factory returns when necessary.

Please specify both model and serial number in all correspondence concerning Systron-Donner instruments. Address all inquiries on operation or applications to your nearest sales representative or Sales Manager, Instruments, Systron-Donner Corporation, 888 Galindo Street, Concord, California.

OPERATING NOTES

CAUTION: Keep the monitor scope intensity at a low level to avoid burning the tube screen.

STANDBY: When making measurements in the 0 to 50 MC range at the 'C' input of the counter, leave the harmonic preset switches on the Model 1292 at "0-0".

RESOLUTION vs. MEASUREMENT TIME:

The time required to make a measurement with the Model 1292 is:

Measurement Time = 3 × Harmonic number × Time Base Setting

The Resolution of the final reading is dependent upon the time base selected on the Model 1037:

Time Base	Resolution
10 sec	± 0.1 cps
1 sec	± 1 cps
0.1 sec	± 10 cps
0.01 sec	± 100 cps
1 msec	± 1 kc
0.1 msec	± 10 kc
0.01 msec	± 100 kc

To keep the measurement time to a minimum, it is important to select the shortest time base commensurate with the required resolution. The resolution need never exceed the actual stability of the signal being measured by a factor of more than 10.

Example: Input is 10 GC (10,000,000,000 cps)

a. If stable to .01% – Need resolution .001% or 100KC or

b. If stable to 1 part in 10^7 – Need resolution of 10^8 or 100 cps

		Harmonic Number		Time Base		
Measurement Time =	a. 3	× 100	×	10^{-5}	=	.003 second
	b. 3	× 100	×	10^{-2}	=	3 seconds

INTRODUCTION

The Model 1292 transfer oscillator plug-in is used in conjunction with the S-D Model 1037 counter to extend the frequency measurement range from 50 megacycles to 15 gigacycles per second. Measurements can be made of CW, AM, FM or pulsed RF signals. These signals may contain considerable noise levels without affecting the ease of accuracy of measurement. CW measurements can be made with the same accuracy and stability of the counter.

Counter accuracy is achieved by an automatic frequency control and phase lock feature which provides tracking of a varying input signal. Harmonic preset switches permit selection of the counter time base so that a direct indication of the input frequency signal is automatically presented on the counter. A panel monitor scope permits one to tune the transfer oscillator precisely to the input frequency by observing a zero beat frequency.

PRINCIPLE OF OPERATION

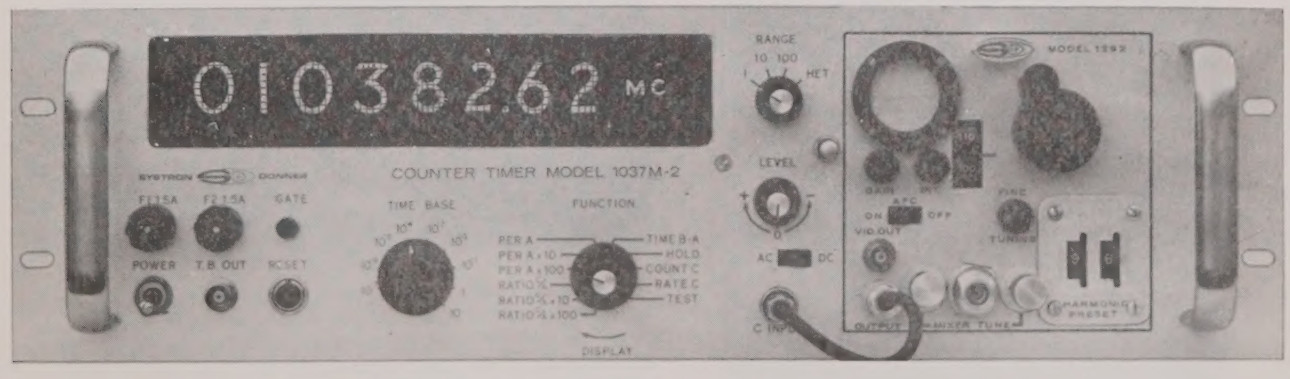
The Transfer Oscillator generates a fundamental frequency which may be varied within the range of 50MC to 150MC. It also generates all harmonics of this fundamental up to the 100th.

To measure the frequency of an input signal, the fundamental is adjusted to the point where one of its harmonics has the same frequency as the input signal. This is done by beating the harmonic against the input signal and varying its frequency until the difference frequency observed on a built-in oscilloscope is zero. Then a frequency equal to the fundamental frequency is indicated on the 50MC Counter. If the counter counted each cycle of this signal for .01, .1 or 1 second, the fundamental frequency would be displayed. To find the input frequency then we would multiply this indication by the harmonic number (N). To avoid this calculation, the counting period is expanded to N times the usual counting period with the result that the input frequency appears directly in decimal digits on the face of the counter. In the "AFC" mode a combination of AFC and Phase Lock is used to synchronize the transfer oscillator with the input signal. Any tendency toward frequency change in either the input signal or the transfer oscillator is immediately compensated for by changing the transfer oscillator frequency to maintain a precise one megacycle beat frequency with the input signal. This can be observed on the self-contained oscilloscope as a 1:1 Lissajous pattern.

SPECIFICATIONS - MODEL 1292 TRANSFER OSCILLATOR PLUG IN

Frequency Range	50 Mc to 15 Gc
Type of Input Signals	Continuous fixed frequency signals with or without amplitude modulation. FM signals. Pulsed RF signals.
Signal Input Sensitivity	Better than 100 mv rms, (—7 dbm) 50 Mc to 12.4 Gc Typically —12 to —40 dbm .5 to 10 Gc, usable to 15 Gc
Maximum Level	2.23 volts or +20 dbm (100 mw)
Impedence	50 ohms nominal
Accuracy	± stability ± resolution of measurements of Transfer Oscillator fundamental. **Stability:** same as 1 Mc reference from 50 Mc Counter in AFC mode. **Resolution:** ±1 count (Model 1037 Counter).
AFC Lock on Range	±0.25% of input frequency
Phase Lock on Range	±0.01% of input frequency

Controls: Fundamental Signal Dial	50 Mc to 150 Mc
Harmonic Preset	1 to 99
Zero Beat Indicator	Self-contained oscilloscope
AFC Switch	"On-Off" control
Vernier Control	For fine tuning
Video Output	For external scope, 0.5 v peak-to-peak.
Power	From Model 1037 50 Mc Counter, 22 w
Environmental Conditions Ambient Temperature	0 to 55°C
Physical Parameters Dimensions	Standard plug-in
Weight	7 lbs.



A complete DC to 15 Gc Measuring System with the Plug-in Transfer Oscillator installed in a 50 Mc Counter-Timer, Model 1037

Operating Procedures

1. IF FREQUENCY IS KNOWN TO WITHIN ±100 MEGACYCLES

The following technique is usually most satisfactory when the frequency to be measured is known to within approximately ±100 Mc.

1. Set counter Time Base switch to 10^{-5} or 10^{-4} position.
2. Set Function switch to RATE after adjusting counter trigger level as described in counter manual.
3. Set Ranger Attenuator to 1.
4. Set Transfer Oscillator controls to AFC-OFF, GATE near maximum and Harmonic Preset to 01.

Example: Frequency is known to be 9.6 Gc ±100 Mc.

1. Adjust tuning stubs for maximum deflection.
2. Find a zero beat by starting at the maximum T.O. frequency (150 Mc) and adjust downward.
3. With the Counter Display Time control set at minimum display time, observe the counter readout.
4. Increase incrementally the Harmonic Preset numbers (thumbwheel preset switches) on T. O. until the readout indiccates 9.6 Gc ±100 Mc. Notice that the Harmonic Preset number above and below the correct answer will be in erro by approximately 150 Mc (the frequency of the T.O.)

2. VERIFY ANSWER

1. Tune to next Higher zero beat.
2. Set Harmonic Number to next Lower number 95 (96-1).
3. Verify answer on counter directly 9612565.1 KC.

If the verification answer on the next higher zero beat is higher than the original measurement then the Harmonic Number selected was too high in both measurements.

3. IF FREQUENCY IS UNKNOWN

1. Set Harmonic Selector to .01.
2. Tune for a zero beat near 150MC (start at 150MC and go down scale until zero beat reached).
3. Read transfer oscillator frequency at zero beat on counter and record five most significant digits (f_H).

14788
- 14564
224

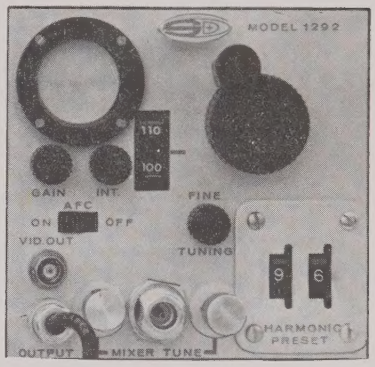
4. Move transfer oscillator to next next lower beat and record five most significant digits(f_L) and subtract.

$\frac{14788}{224} = 66$

5. Divide difference into higher frequency (f_H) (slide rule accuracy) and get whole number harmonic "66" of lower frequency (f_L).
6. Set harmonic switches to 66 with zero beat (f_L) still on scope and readout answer directly on counter "9612565.1KC".

Verification of the answer can be made exactly as described previously by tuning to the next higher zero beat (f_H) and set harmonic number at 65 (66-1).

MODEL 1292 CONTROLS



MIXER Tuning: For low input voltage signals, at or below the typical sensitivity curve (Figure 12), adjustment of the tuning stubs in the mixer may be required. Tune for maximum amplitude of zero beat.

GAIN Control: After mixer is tuned (if required), the GAIN control should be adjusted so that a zero beat causes a vertical indication of approximately ½ to ¾ inches with the AFC switch in the OFF position.

When using the AFC in the ON mode, the GAIN control should be adjusted to a ½ to ¾ inch vertical presentation. It may be convenient to externally attenuate the input signal if the available signal voltage is much larger than that shown on the typical sensitivity curve (Figure 12).

FINE Tuning: This is the vernier control of the main oscillator tuning control, and is used for precise adjustment of zero beat.

OSCILLATOR Tuning: Main tuning control with a range of 50 Mc to 150 Mc. Start at high end of dial and adjust downward to obtain a zero beat of some harmonic.

INTENSITY Control: Used to adjust brightness of waveform on built-in scope.

VIDEO Output Jack: For use with an external scope to display the zero beat. Used primarily in applications requiring greater bandwidth and/or sensitivity than provided by built-in scope.

HARMONIC PRESET Switches: Two thumbwheel switches can be set to any number from 01 to 99. Used to multiply time base of counter to yield *direct* indications of input frequency.

PRECISE MEASUREMENTS – COUNTER ACCURACY WITH PHASE LOCK

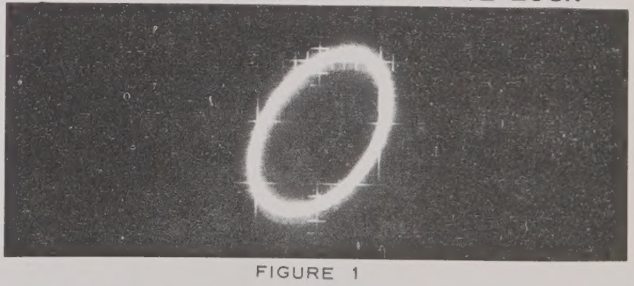


FIGURE 1

If a highly precise reading is required (to counter accuracy), the "AFC" mode of operation can be used after normal measurements. In the AFC mode, the transfer oscillator is locked to the input frequency such that a precise 1 MC beat is achieved. A 1:1 Lissajous pattern on the self-contained oscilloscope permits the operator to achieve a precise 1 MC offset. This pattern is shown in Figure 2. The 1 MC offset is accounted for by adding 1 MC to the reading displayed on the counter.

CW MEASUREMENTS

To measure a CW frequency signal, the transfer oscillator is tuned while observing the difference frequency on the self-contained oscilloscope. As the zero beat frequency is approached, the pattern will be similar to Figure 3.

FIGURE 3

As the transfer oscillator is fine tuned, the pattern will approach a horizontal line as shown successively in Figure 4 and 5, if a perfect zero beat can be obtained.

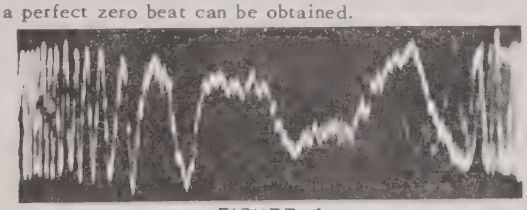


FIGURE 4

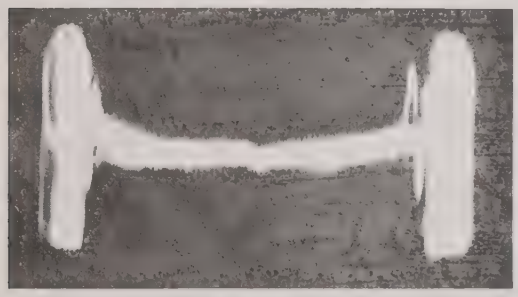


FIGURE 5

In actual practice, few input signals will be stable enough so that a simple zero beat can be obtained. Most input signals will have enough short term instability so that the best obtainable zero beat will more closely resemble Figure 4. In the AFC mode, the transfer oscillator can be locked to the input signal and the measurement made. This will result in a reading which will be an average frequency over the measuring period.

Short term instability can often be treated as FM where it is desirable to know the limits of frequency excursion of a varying input signal. This can easily be done by adjusting the transfer oscillator so that the zero beat is positioned at the two edges of the pattern (Figure 6 and 7).

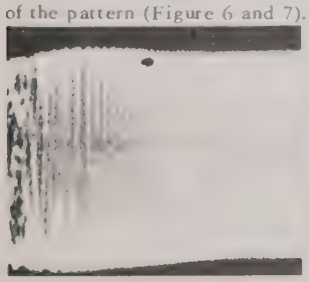


FIGURE 6

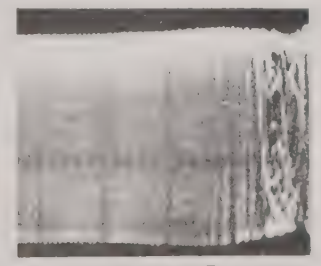


FIGURE 7

The frequencies measured at these two zero beats are the limits between which the signal is varying.

FM MEASUREMENTS

Signals which are frequency modulated at 60 or 120 cps can be measured using the built-in oscilloscope. For frequencies modulated at frequencies other than 60 or 120 cps, the video output signal from the front panel connector on the transfer oscillator may be displayed on an external scope swept by the modulation signal.

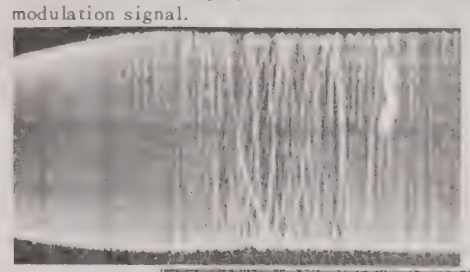


FIGURE 8

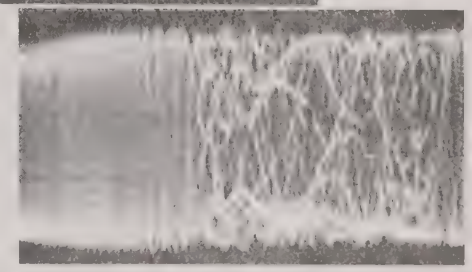


FIGURE 9

The oscilloscope patterns near zero beat will be similar to Figure 8 and 9. The input frequency will pass through zero beat twice during each sweep cycle. These points appear as regions of minimum frequency in the oscilloscope pattern.

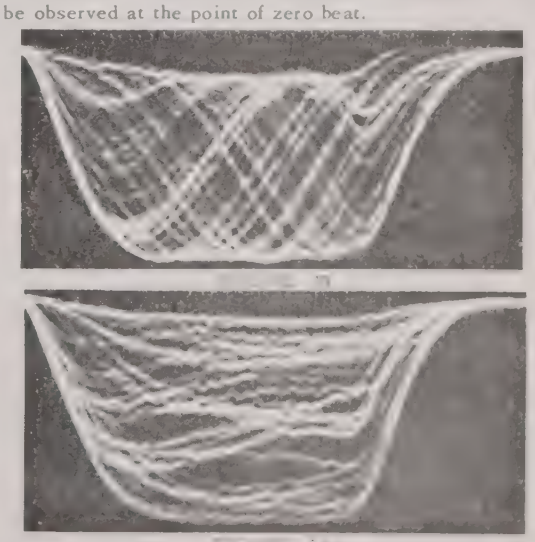
The frequency deviation of the signal can be measured by varying the transfer oscillator frequency until the zero beat appears first at one end and then the other end of the sweep span as shown in Figures 6 and 7. The frequency deviation will then be the difference between the indicated frequency at each extreme. The center frequency will be that indicated with the zero beat point at the middle of the sweep.

PULSED RF MEASUREMENTS

The carrier frequency of pulses as short as one microsecond can be measured using an external oscilloscope.

The output of the mixer is amplified and brought out at the Video Out jack on the front panel. This signal can be coupled to the vertical input of an external oscilloscope. The sweep must be synchronized with the pulse rate.

As the transfer oscillator is tuned near a zero beat, the pattern on the oscilloscope will be similar to Figure 10. When the transfer oscillator is fine tuned, a pattern similar to Figure 11 will be observed at the point of zero beat.



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SETTING THE HARMONIC NUMBER

When the zero beat is obtained, the frequency being measured will be equal to the frequency of the transfer oscillator multiplied by harmonic causing the beat. The proper harmonic number can usually be set into the two digit harmonic preset switch at once, because the approximate value of the frequency being measured is usually known (to 1 or 2 percent). Even if the approximate value is completely unknown, however, the harmonic number can still be obtained easily by making two short measurements. For example, if a frequency of approximately 9 GC were to be measured, the transfer oscillator could be tuned to 150MC (f_H) where the zero beat would be caused by the 60th harmonic. The counter will then readout 90000000 or any eight digits of the measured frequency depending on the setting of the time base switch on the counter. The answer should be verified by now setting the transfer oscillator to the next lower frequency that causes a zero beat. We know that the next lower zero beat must be caused by the next higher harmonic. In the example mentioned, this zero beat would occur when the transfer oscillator is tuned to 147.54MC. With the harmonic preset switch set to 61 (60 + 1), the answer is verified on the counter. Calculation is not usually made since if the reading checks higher at f_H than the reading at f_L then N is set too high and should be reduced so that the reading is verified.

Mathematically this can be expressed by the equation

$$F_{IN} = Nf_H = (N + 1)f_L$$

where F_{IN} = the input frequency

f_H = the higher fundamental frequency whose Nth harmonic causes a zero beat with the input frequency

N = the harmonic number of the higher fundamental frequency (f_H)

f_L = the next lower fundamental frequency that will have a harmonic (N + 1) causing a zero beat with the input frequency

or to substitute the values used in the example above we have

$$9\ GC = 60 \times 150\,MC = 61 \times 147.54\,MC$$

To find the harmonic number the equation can be solved for N as follows:

$$Nf_H = (N + 1)f_L$$

$$Nf_H = Nf_L + f_L$$

$$Nf_H - Nf_L = f_L$$

$$N(f_H - f_L) = f_L$$

$$N = \frac{f_L}{f_H - f_L}$$

SENSITIVITY

The required signal level varies with frequency typically as shown in Figure 12. A minimum usable signal level will produce a S/N Ratio of 6 db at the Video Amplifier output. This represents the signal necessary to produce a usable vertical deflection of the internal oscilloscope. The Model 1292 contains a broadband two-stub tunable mixer. This mixer provides a means of obtaining the best sensitivity at a given frequency so that low level signals may be measured. The efficiency of the mixer falls off as higher frequencies are measured with the resultant loss in sensitivity. A similar loss of efficiency and sensitivity occurs as lower frequencies are measured. This results in the curve shown in Figure 12 which is on the order of 7 to 70 millivolts rms (-30 to-10 dbm) from 0.5 to 10 GC and better than 100 millivolts rms (-7 dbm) from 50 to 500MC and 10 to 12.4 GC.

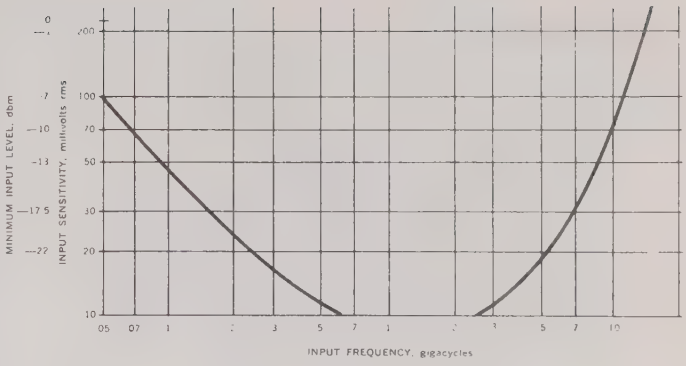


FIGURE 12

TYPICAL SENSITIVITY VS. FREQUENCY

ACCURACY

CW MEASUREMENTS

The possible error involved in measuring a CW frequency can be divided into two parts. First is the error of the frequency counter in measuring the transfer oscillator frequency which is ± stability ± 1 count. Stability of the S-D Model 1037B is better than 1 part in 10^9 per day. With the ± 1 count error reduced to less than ± 1 part in 10^9 by selecting an appropriate time base, CW signals over 1 GC can be measured with counter error reduced to less than ± 2 parts in 10^9. The second part of the possible error involves comparing the transfer oscillator frequency and/or harmonics with the frequency to be measured. In the "AFC - On" mode, this error can be reduced to virtually zero with the transfer oscillator locked to a stable input signal. When using the transfer oscillator with the "AFC - Off" this error is on the order of ± 1 part in 10^7 due to the drift of the transfer oscillator during the measurement plus a possible ± 1 part in 10^7 error depending on operator skill. Both of these errors are essentially eliminated in the AFC mode and thus the accuracy achieved is as good as the accuracy of the basic counter.

FM MEASUREMENTS

When measuring the center frequency of a frequency modulated signal, error is introduced by several sources. In addition to the accuracy of the counter measuring the fundamental transfer oscillator frequency (± 1 count, ± stability), there is the amount of deviation of the harmonic frequency from a precise zero beat with the input signal and the short term drift (during measurement) of the fundamental transfer oscillator frequency. A fine tuning control on the transfer oscillator permits measurements with a precision approaching ± 10KC to be achieved in tuning to the zero beat. The drift of the transfer oscillator during a one second measurement time is on the order of ± 1 part in 10^7.

PULSED RF MEASUREMENTS

The accuracy with which pulsed RF measurement can be made depends on the same sources of error present in FM signal measurements. The harmonic frequency deviation from a precise zero beat with the input signal can be reduced to the order of 0.01 cycles per pulse width. The drift of the transfer oscillator can usually be neglected since most pulsed RF measurements will have a pulse width less than 100 μ seconds.

THEORY OF OPERATION

The system is described in the Block Diagram, Figure 13. The VFO generates a stable signal, adjustable in frequency from 50MC to 150MC which is divided by three and then measured by the 50MC counter. Harmonics of the VFO are then compared in a tuner mixer with the frequency to be measured. The difference frequency is adjusted to a zero beat using the built-in oscilloscope in the plug-in. By appropriate adjustment of the transfer oscillator, a zero beat can be obtained between a transfer oscillator fundamental or harmonic and any unknown frequency from 50MC to 15GC. When the zero beat is obtained, the harmonic number is set into the preset switches and this automatically selects the time base so that a direct indication is presented on the counter. Where accuracy of better than 1 part in 10^8 is desired or where it is necessary to track a varying input signal, an AFC control is provided. The AFC locks the transfer oscillator to the input signal and maintains a one megacycle offset. With this technique, measurement accuracy is that of the basic counter, typically 1 part in 10^9 with the S-D Model 1037B.

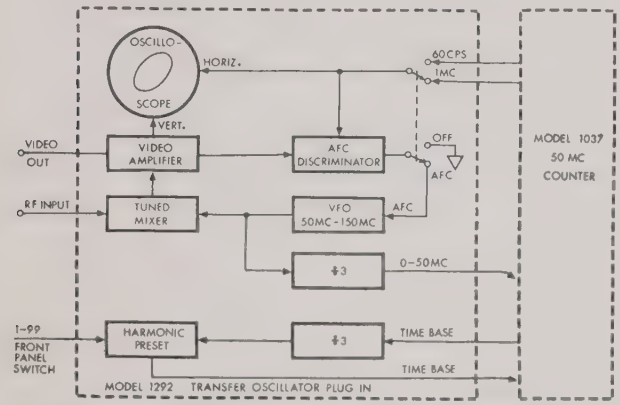


FIGURE 13. SIMPLIFIED BLOCK DIAGRAM

AFC-PHASE LOCK

The AFC circuit used differs slightly from an ordinary frequency control loop system. The one megacycle standard from the counter is used for both the indication of lock in the display pattern and to produce a phase locked action.

The combined one megacycle standard and the beat frequency at the amplifier are sampled by the frequency discriminator. The derived signal is a function of the shift from the one megacycle discriminator center frequency. This discriminator output level is then fed back to control the frequency of the oscillator.

The oscillator is frequency controlled by a variable reactance diode arrangement in the oscillator tuned circuit.

When the system is frequency locked, the control signal will assist the operation of fine tuning the oscillator to a phase locked condition. At this point, the discriminator becomes a phase detector and its output will be a varying voltage proportioned to the difference in the phase between the beat frequency and the standard.

In a typical phase locked loop, the rate of change of the input signal frequency must be slow enough to remain within the bandwidth of the loop.

The combined AFC-phase locked loop used in the system described, allows an excursion in frequency governed by the bandwith of the crystal discriminator. The discriminator performs a dual function and adds versatility to the instrument. Over the discriminator bandwith, oscillator tuning is broad due to the gain of the AFC loop. As the offset frequency is varied by tuning to within a few cycles of the one megacycle frequency standard, the discriminator performs a mixing function. The output is a control signal and is a product of the phase difference of the two signals.

Automatic frequency control facilitates tuning by reducing the fine tuning required. The control feature is especially valuable in that with lock achieved the oscillator will follow drifts in the frequency of the incoming signal. Conversely, it will hold a locked condition despite variations of internal components. Frequency control of a shift in signal frequency is possible as long as the carrier frequency remains within the linear range of the discriminator response. The AFC of an FM signal is possible when deviation is small and modulation rate is low. AFC control is possible with high modulation rates and deviation, provided the modulation index is chosen to retain sufficient power at the carrier for discriminator action.

Figure 13 illustrates a frequency control arrangement where the transfer oscillator is locked to the input frequency so that a one megacycle beat is achieved. A crystal discriminator is used to sample the offset frequency and provide control to one side band only. To insure precision of the offset and phase lock condition, the beat is compared with the one megacycle derived from the counter time base standard. The resulting 1:1 Lissajous pattern on the self-contained oscilloscope permits the operator to see that he has achieved a precise one megacycle offset. The one megacycle offset is accounted for by adding one megacycle to the frequency reading displayed on the counter.

OBTAINING DIRECT READOUT

A brief discussion of the digital system of counting may be helpful in understanding the system.

In the electronic digital counter, it is the number of pulses or events during a given length of time that is counted. A gate opening of one millisecond results in counting the number of cycles for a one millisecond period. The counter used in the system described has a basic range from 0 to 50 megacycles. In order to count and display the oscillator frequency over the range of 50MC to 150MC, the oscillator frequency is divided by three resulting in frequencies from 16.66 to 50MC that are accepted by the counter. The time base is then extended to three times the normal counting period and the counter will thereby count the oscillator frequency accurately and readout the frequency directly.

By the arrangement of two "Harmonic Number" decades and controlling circuitry a further extension of the time base is achieved. Any factor from 1 to 99 can be selected by the harmonic number switch on the transfer oscillator.

Upon setting the harmonic number, the oscillator frequency will be multiplied automatically and the counter will then display the measured frequency directly.

This preset feature allows the operator to approximate his harmonic number for quick measurements. Upon obtaining a frequency reading, a check is easily accomplished by dropping down to the next lower frequency that provides a zero beat and raising the harmonic number setting by one.

INDIVIDUAL CIRCUITS

The detailed block diagram of the Model 1292 Transfer Oscillator is shown in Dwg. 15192. The individual circuit blocks are described below:

VARIABLE FREQUENCY OSCILLATOR AND AMPLIFIER, DIVIDE-BY-THREE PRESCALER

Refer to Dwg. 14871. The variable frequency oscillator (VFO) is a Clapp type circuit consisting of Q101 and associated components followed by a two-stage tuned amplifier. The main tuning control, L1, is a ganged variable inductor common to the oscillator and amplifier stages. Each stage is designed to operate over the range of 50 to 150 MC. Fine tuning of the oscillator tank circuit is accomplished by a variable reactance diode, CR101. Varying the DC potential applied to the diode by R1, the front panel fine tuning control, changes the effective reactance of the diode and, consequently, the oscillator frequency. In the "AFC on" position of switch S1 (front panel), the junction between R103 and R106 is ungrounded, which adds the discriminator output control signal to the fine tuning circuit so that the corresponding oscillator harmonic locks in with the input frequency, producing a 1 MC beat frequency, (described under "Theory of Operation") which is displayed on the panel scope.

The oscillator output frequency is applied to the Harmonic Generator and Mixer through C106 and also to a divide-by-three circuit, the output of which is applied to the counter frequency input jack.

Q105/Q106 is a differential limiter amplifier which drives the divide-by-three prescaler.

DIVIDE-BY-3 PRESCALER

The divide-by-three prescaler is a three stage ring counter circuit. The rectangular waveform at the collector or any stage changes state at one third the frequency of the applied input signal. The output taken at the collector of Q111 is coupled through emitter follower Q113 to J1, the front panel frequency output jack. Q114 is a voltage regulator stage which drops the +30V level down to +15V. The fixed reference voltage for the regulator is suppled by Zener diode CR106.

A further voltage drop to +10V regulated for the fine tuning circuit of the oscillator section is obtained by means of Zener CR102.

TIME BASE SCALE OF 3 AND GATING CIRCUIT

Refer to Dwg. 14873. The Scale of 3 circuit extends the time base of the counter by a factor of 3 to compensate for the division by 3 of the VFO frequency which is applied to the counter. The circuit consists of a driver stage Q401 which applies the original time base frequency (normally 100 cps) to both the scale of 3 and the gating circuit, as shown in Figure 15. The scale of three consists of two cascaded binary stages having gating circuits which permute the normal scale of 4 to a scale of 3. Figure 14 illustrates the operation.

The basic principles of the circuitry are similar to the decade units described in section 8 of the accompanying counter manual and are not repeated here. The output taken at the collector of Q404 changes at one third the rate of the input signal. It is applied from terminal C to the preset decades.

GATING CIRCUITRY

A simplified block diagram of the gating circuitry is shown in Figure 15. The gate control signal from the counter is applied through amplifier Q408 and inverter Q409 so that a 0V level is applied to the "Gate Control" input of Gate A in the "gate closed" condition. Gate A then passes the time base pulses to amplifier Q410 and inverter Q407 to the time base out terminal, and one of these pulses starts the counting cycle in the counter after completion of the "inhibit start" function. Immediately, the gate in the counter changes to the "count" condition and the gate control signal applied to Gate A changes to +12V which closes this gate. Figure 16 illustrates Gate A. When the output of Q409 is 0V (not counting), the time base signal passes through CR406. When the output is +12V (counting), CR406 is reverse-biased and cannot conduct. Gate B is identical. Gate B remains closed during this entire time since it requires a coincidence pulse from the preset decades to cause it to open. When the coincidence pulse occurs, (See "Harmonic Preset Circuitry.") Gate B opens and passes the time base signal again to Q410. The first pulse closes the gate, stopping the counting cycle in the counter. Gate B is immediately closed following the coincidence pulse and Gate A is once again open, but a new counting cycle cannot commence until the reset action in the counter is completed.

The coincidence input at terminal K is normally at 0 volts (non-coincidence). Q411 is cutoff and its collector has a +12V potential which holds Gate B closed. When the coincidence output occurs, the 0V ground potential is removed, Q411 conducts and its output changes to 0V which opens Gate B.

Q406 provides a reset level signal to the Scale of 3 binaries and to the harmonic preset decades. As long as the gate control signal is "off" (−6V), a +12V level at the collector of Q406 holds the scale of 3 and preset decades in the reset condition. When the gate is open, the level changes to 0V and the binaries are released from the reset condition.

HARMONIC GENERATOR AND MIXER

Refer to Dwg. 14875. The output of the oscillator in the range of 50 to 150 MC is applied to the harmonic generator. This consists of a diode CR602 located in the mixer assembly which generates an indefinite series of harmonics of the selected oscillator frequency. The input signal to be measured is mixed with the harmonic output signal by means of mixer diode CR601 located in the assembly. Two tuning rods are provided for maximum sensitivity, as observed on the monitor scope. The usable output of the mixer is the difference frequency resulting from the mixing of the input signal and the corresponding oscillator harmonic. This difference signal output at J4 is applied to the video amplifier for display on the scope. R324 is a DC bias level adjust for the mixer diode.

VIDEO AMPLIFIER (Dwg. 14875)

The video amplifier is a seven-stage, feedback compensated amplifier circuit (Q302 to Q308), designed to operate over the range of 10 cps to 2.5 MC. A voltage gain control (R3 on the front panel) located between stages Q304 and Q305 determines the vertical gain of the image displayed on the oscilloscope. The output of the video amplifier is taken at the collector of Q308 (a common-base configuration) and applied directly to the scope circuit through L302. It is also applied to the discriminator circuit through R312. Another output to the external scope jack J2 is taken from a preceding emitter follower stage, Q306.

DISCRIMINATOR

In the "AFC on" condition, two inputs are applied to the discriminator circuit; the precise 1 MC reference frequency from the counter through C310 and the nominal 1 MC difference frequency from the video amplifier. A 1MC crystal, XY301, establishes the center frequency of the discriminator circuit. When the video input differs from 1 MC, a positive or negative error signal is applied to the variable reactance fine tuning circuit in the VFO, correcting the frequency in such a way as to make the video output exactly 1 MC. The functions of the adjustable capacitors are described in the discriminator calibration procedure.

When the video output is very close to 1 MC, diodes CR305 and CR306 provide a mixing action with the 1 MC reference frequency. The resulting output level from this action is a control signal which is derived from the phase difference between the 1 MC counter standard and maintains a precise 1 MC offset.

C325 adjusts the output of the discriminator for zero volts at 1 MC and C316 adjusts the symmetry of the characteristic response curve of the discriminator.

1 MC REFERENCE INPUT SELECTION

In the "AFC on" condition, the emitter or Q301 is grounded. This stage amplities the 1 MC standard frequency from the counter, passing it through C302 to the horizontal deflection-plates or the CRT and also through C310 to the discriminator. The amplitude at pin 317 is approximately 100 volts peak-peak. When the emitter of Q301 is not grounded, the signal is blocked. Switch S1 selects a 60 cps, 85 volt r.m.s. signal from the transformer for horizontal deflection in the AFC off position.

CRT POWER SUPPLY

±500 volts for the CRT is provided by the rectifier circuit (CR301 to CR304) operating from the high voltage transformer.

HARMONIC PRESET CIRCUITRY

Refer to Dwg. 14872. The circuitry consists of two decade units essentially the same as the decades described in section 8 of the basic counter instruction manual, but with one important difference. In a normal decade unit, a single output pulse is obtained at the 4th binary stage with the occurrence of every ten input pulses. Division by 10 is performed. In the preset decade, output lines are taken from each of the four binary stages. A ten position switch combines the outputs which used to represent the desired harmonic number according to the scheme given in table 1. If, for example, the switch is set at "8", all selected output lines will be at +12V on the 8th input pulses after reset and the gate formed by diodes CR519 to CR522 or CR523 to CR526 will be closed. This condition is equivalent to the coincidence signal. For all other input pulses, the output of at least one of the selected lines will be 0V and no coincidence condition will exist.

CENTERING CIRCUITRY

Refer to Dwg. 14877. The rear panel controls found on this module are identified as follows:

R204 - vertical positioning; R206 - horizontal positioning; R207 - focus; C206 - horizontal drive. The horizontal drive signal applied to terminal 218 is either a 60 cps 85V(rms) signal from the transformer in the AFC off position, or the 1MC 100V (peak-peak) signal in the AFC on position.

TABLE I

PRESET BINARY SWITCH CODE SELECTION

Switch Position	Binary Output				Common
	8	4	2	1	
0					x
1				x	x
2			x		x
3			x	x	x
4		x			x
5		x		x	x
6		x	x		x
7		x	x	x	x
8	x				x
9	x			x	x

ALIGMENT AND TUNING PROCEDURE FOR VIDEO AMPLIFIER AND CRYSTAL DISCRIMINATOR

1. Connect the Model 1292 to the counter by means of the service extension cable.* Use test set-up shown in Figure 17.
2. Rotate the 1292 main tuning dial to approximately 150 MC (about one full turn from the extreme clockwise position).
3. Switch to AFC off position.
4. Adjust trimmer capacitors C119 through C126 for a maximum RF output voltage indicated by the voltmeter. Repeat this step. The output should indicate approximately 1.5V rms (= 55 milliwatts with 50-ohm termination).
5. Adjust potentiometer R137 to obtain a stable reading on the counter of approximately 150,000.00 KC. (This adjusts input bias level for ring counter). Set preset switches in "0 1" position.
6. Adjust C119 (oscillator frequency adjust) to obtain a counter reading to agree with dial setting.
7. Turn the main tuning control counter clockwise. The frequency range must cover the range of 150 MC down to 50 MC.
8. Readjust R137, if necessary, to obtain a stable count over the entire frequency range.
9. Apply a 1 MC signal of approximately 100 microvolts (rms) from the generator connected to P4 (the mating connector of the mixer, marked "MIX").
10. With the external scope connected to the discriminator lead (terminal 108), adjust C118 for minimum 1 MC output.

* Part No. 25-15550 .

VIDEO AMPLIFIER AND CRYSTAL DISCRIMINATOR ALIGNMENT PROCEDURE

1. Using the same test set-up as in Figure 17 except with the external scope connected to the external scope jack, apply an input signal of 1 MC, 100 microvolts RMS. Reconnect the external scope as shown in Figure 17. A signal of approximately 1 volt will appear on the external scope.
2. Check that the deflection on the panel monitor scope is approximately ¾ inches peak-peak.
3. Turn AFC on. Set up for DC input, 1V/cm vertical deflection. (Ext. Scope).
4. Adjust the signal generator frequency critically until a 1:1 Lissajous pattern (circle) is displayed on the panel scope.
5. Adjust C325 to obtain zero DC voltage on the external scope.
6. Vary the signal generator frequency above and below the precise 1MC setting and measure the maximum deviation from zero volts in either direction with the external scope. If necessary, adjust trimmer C316 to obtain equal deviation in either direction.
7. Repeat the preceding step several times, if necessary.
8. Turn AFC off. Readjust the input signal to 1MC and adjust trimmer C315 for maximum deflection on the panel scope.

MIXER ADJUSTMENT

1. Reconnect P4 and P5 (HG) and (MIX) is normal manner. Apply a signal to the Transfer Oscillator input jack of approximately 12,000 MC at approximately 70 millivolts rms. (−10 dbm input sensitivity level).
2. Turn AFC off. Tune the Transfer Oscillator to about 140MC.
3. Adjust R324 for maximum deflection, alternating this adjustment with the two tuning rod adjustments.

DISASSEMBLY

MIXER ASSEMBLY

1. Remove the hex coupling nut on the front panel input jack.
2. Remove the two screws (Allen head or Phillips) which are accessible from each side of the mixer assembly and mount it to the chassis. Slide the unit out from the bottom.
3. To change either the mixer or harmonic generator diodes, unscrew the connector designated MIX or HG. The diode is inserted between the connector and the brass fitting which is actually a capacitor. Note that insulating tape is used around the entire circumference of the capacitor. Ordinary Scotch tape may be used for this purpose.

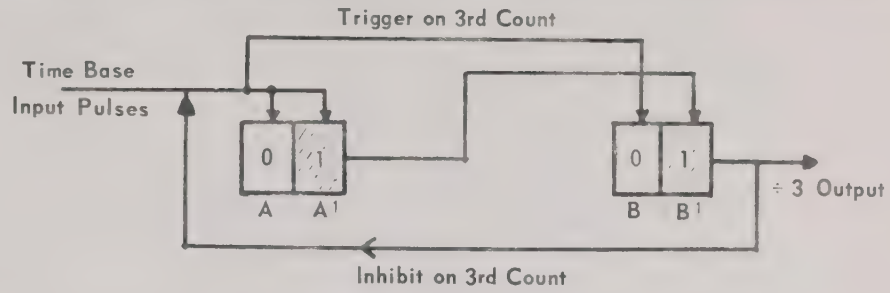
   To facilitate unscrewing the BNC connector to which the HG and MIX diodes are attached, a mating BNC connector and cable may be used to simplify removal and replacement.

CATHODE RAY TUBE REPLACEMENT

The CRT can be pulled out after the front panel retaining ring is removed.

REPLACING COMPONENTS

Dismount component boards from the chassis before removing or replacing components.



Input Count	A	A'	B	B'
(Reset) 0	0	1	0	1
1	1	0	0	1
2	0	1	1	0
3	0	1	0	1
	(Repeats)			

÷ 3 Output

FIGURE 14. OPERATION OF BINARIES

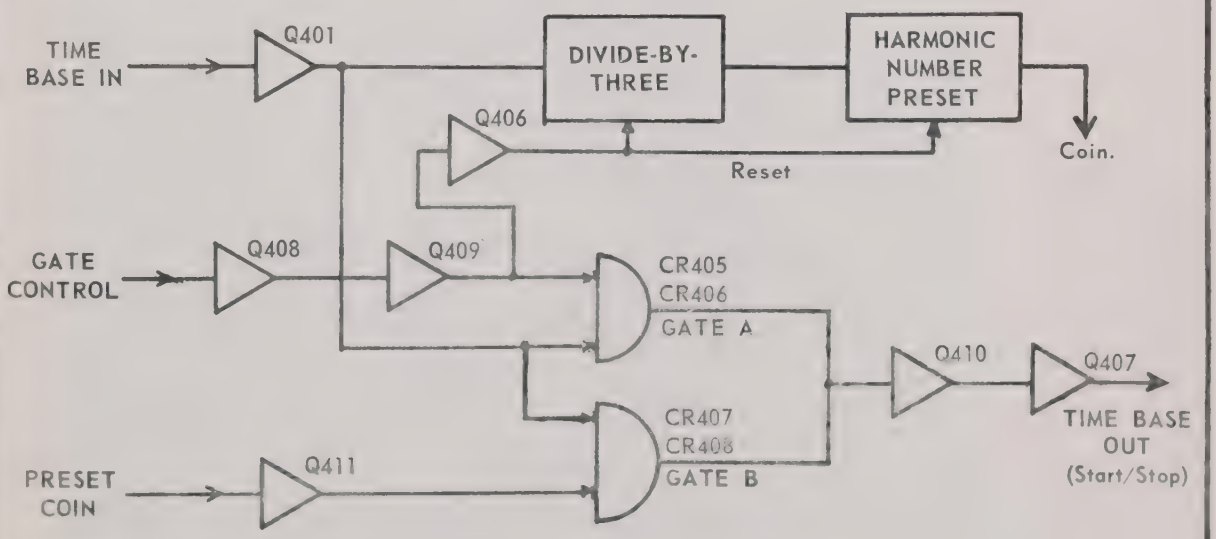


FIGURE 15. BLOCK DIAGRAM OF TIME BASE GATING CIRCUIT

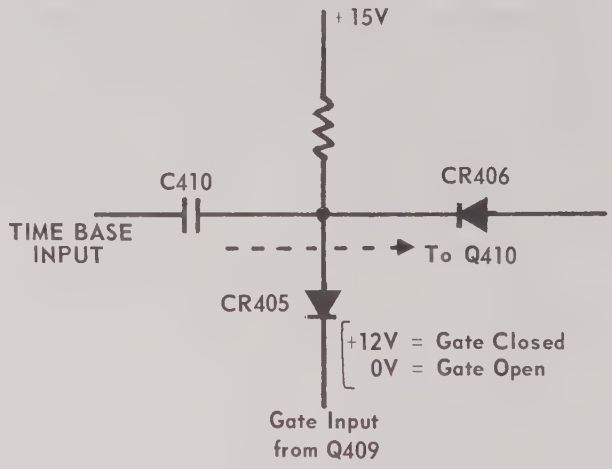


FIGURE 16. GATE A (Detail)

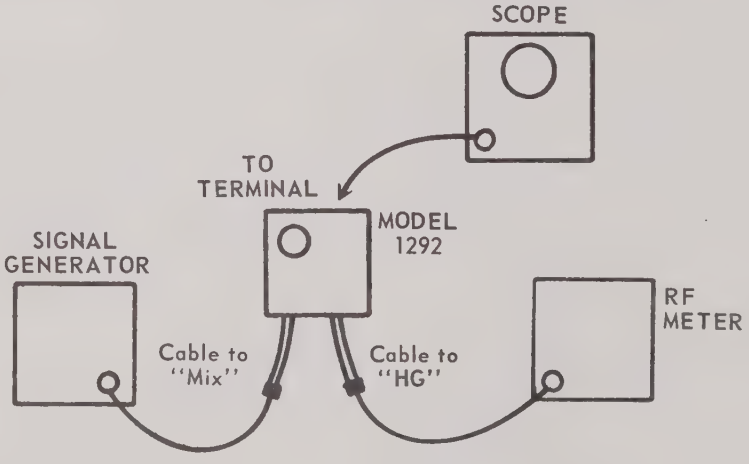
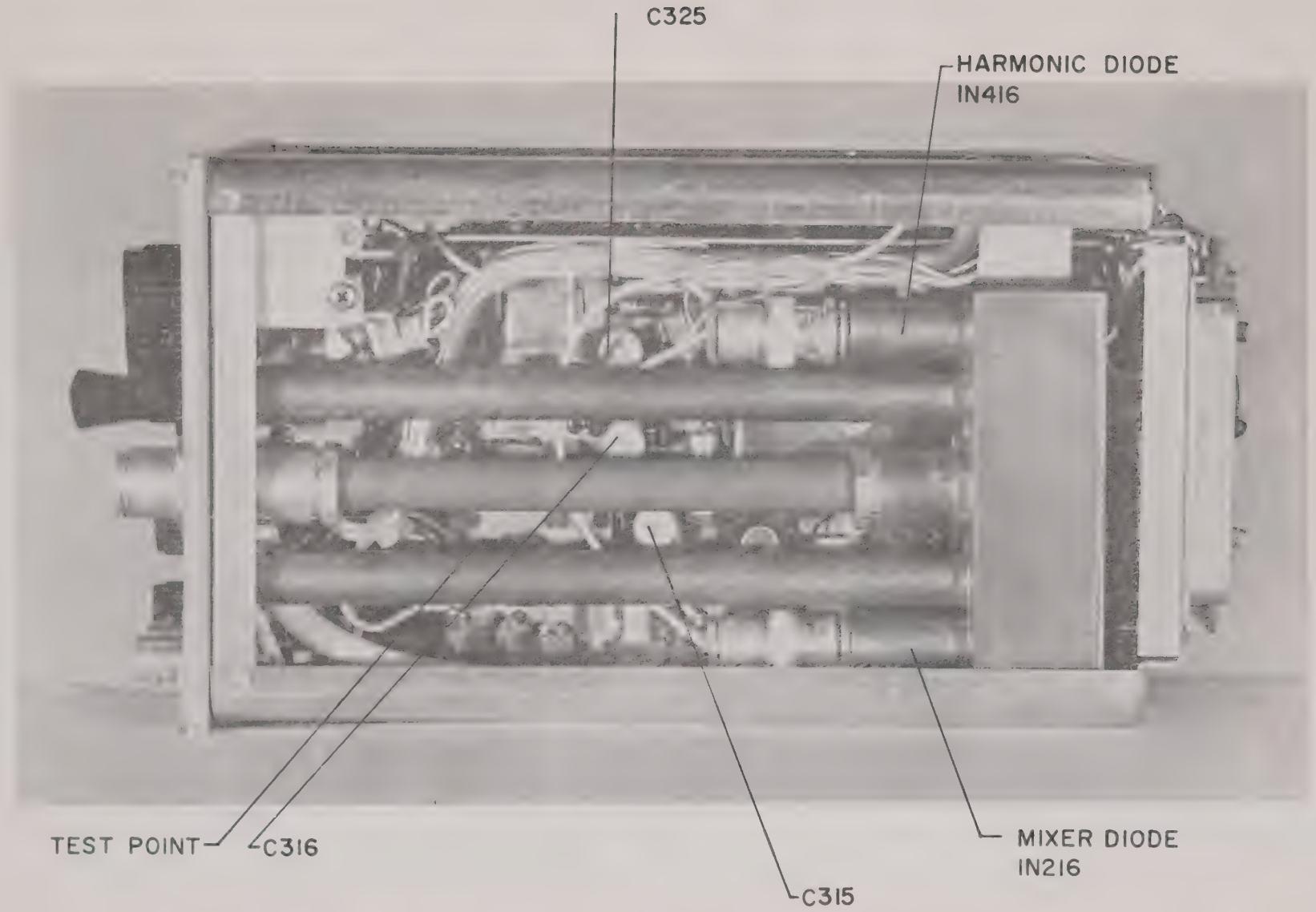
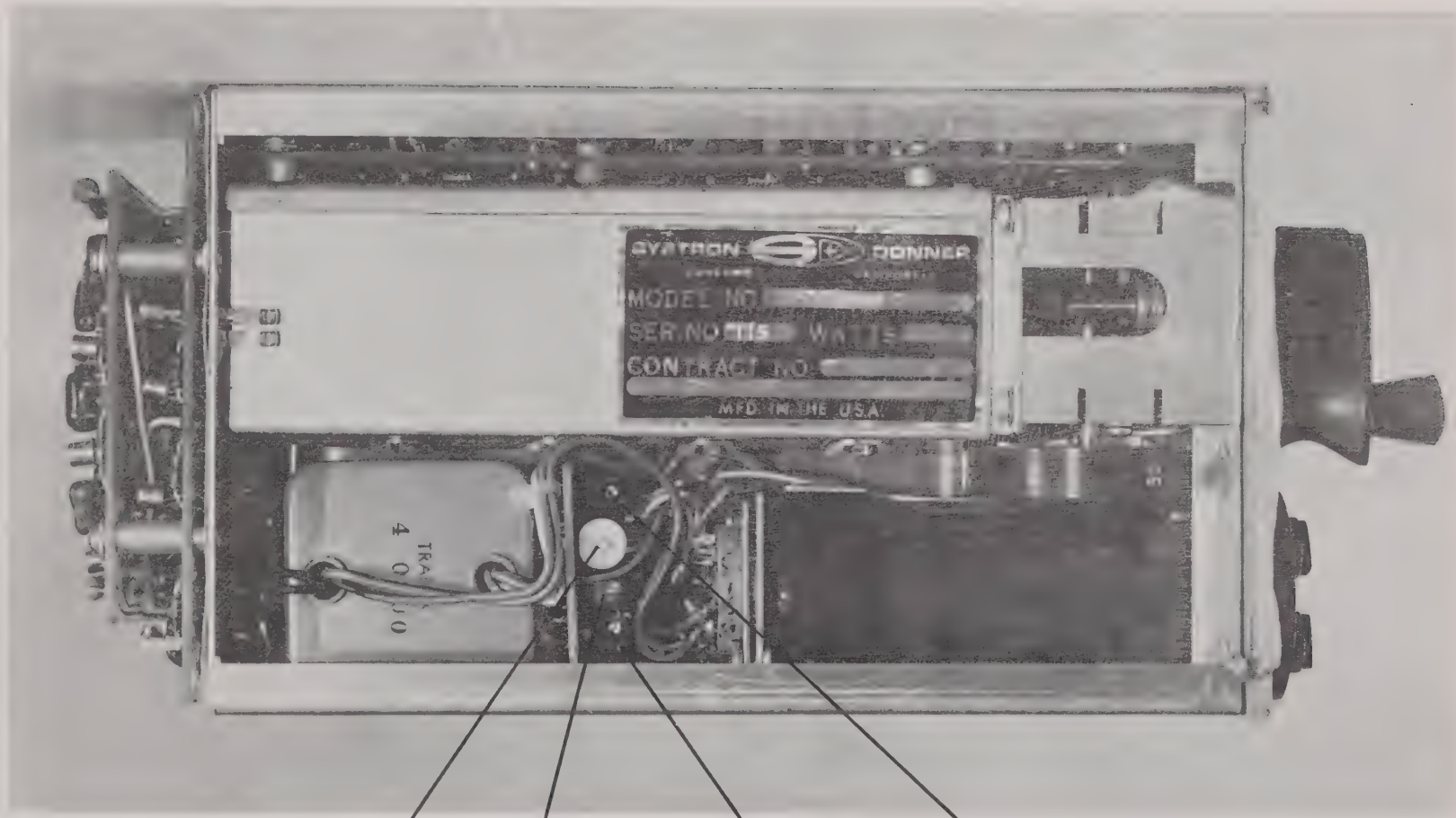


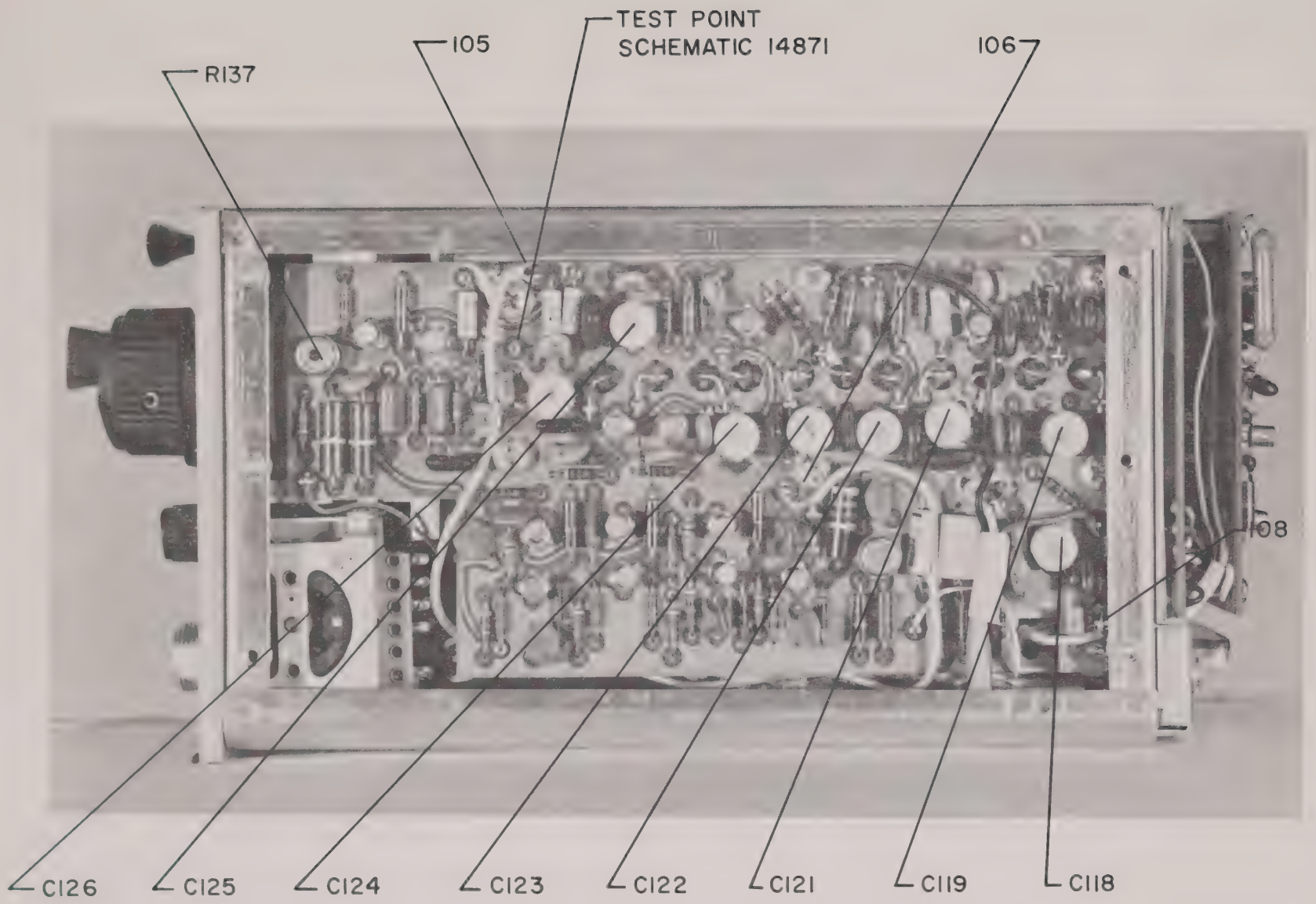
FIGURE 17. TEST SETUP



BOTTOM VIEW OF MODEL 1292 (1292M-1) SHOWING ADJUSTMENT POINTS



TOP VIEW OF MODEL 1292 (1292M-1)



SIDE VIEW OF MODEL 1292 (1292M-1)

MASTER PARTS LIST — Model 1292

CAPACITORS

Systron-Donner Part No.	Description	Mfr. Manufacturer — Part No.
C-0105	.10uf, 600V, mylar paper tub.	Sprague 6TMP1
C-0233	.01uf +60, -40%, 150V, ceramic disc	Centralab DDM-103
C-0236	0.1 uf, 100V, ±20%, metalized paper	Electron Prod. M1-104
C-0325	.005uf, 10%, 150V, ceramic disc	Centralab DDM-502
C-0365	10uf, 25V, elec. tub.	Sprague TE 1204
C-0371	22uf, 25V, ±20%, tant. wet slug	Sprague 109D226X0025C2
C-0378	22pf, 500V, ±5%, dip. sil. mica	Cornell Dub. CD-15C-220J
C-0399	.10uf, 400V, ±20%, mylar, met. epox	Electron DE 4-104
C-0424	.001uf, 500V, ±20%, cer. disc,	R.M.C. Type B
C-0425	.005uf, 500V, ±20%, cer. disc	R.M.C. SM Series
C-0524	1.0 uf, 35V, ±20%, tant.	TI, SCM105FP035D4
C-0527	10pf, 10%, 500V, dip. sil. mica	ElMenco DM-15C-100K-500V
C-0528	15pf, 10%, 500V, dip. sil. mica	El Menco DM-15-C-150K-500V
C-0529	22pf, 10%, 500V, dip. sil. mica	ElMenco DM-15C-220K-500V
C-0531	33pf, 10%, 500V, dip. sil. mica	ElMenco DM-15C-330K-500V
C-0532	39pf, 500V, ±10%, dip. sil. mica	ElMenco DM-15E-390K-500V
C-0533	47pf, ±10%, 500V, dip. sil. mica	ElMenco DM-15E-470K-500V
C-0534	56pf, 500V, ±10%, dip. sil. mica	ElMenco DM-15E-560K-500V
C-0535	82pf, 10%, 500V, dip. sil. mica	ElMenco DM-15E-820K-500V
C-0536	100pf, 10%, 500V, dip. sil. mica	ElMenco DM-15F-101K-500V
C-0539	270pf, 10%, 500V, dip. sil. mica	ElMenco DM-15F-271K-500V
C-0562	.01uf, 500V, ±20%, cer. disc	Sprague 19C214
C-0596	5pf, 10%, 500V, dip. sil. mica	ElMenco DM-15C-050-500V
C-0643	180pf, 10%, 500V, dip. sil. mica	ElMenco DM15F-181K-500V
C-0644	560pf, 10%, 500V, dip. sil. mica	ElMenco DM-15E-561K-500V
C-0648	Trimmer 5.5-18pf, NPO	Erie 538-002
C-0709	Trimmer 9-35pf	Erie 538-011-E2 PO-94R
C-0712	Trimmer 5.5-18pf	Erie 538-011 NPO5.5-18
C-0720	.47mfd, 10V, ±20%, cer. disc	Centralab Ultra Kap
C-0788	.047uf, 100V, ±20%, mylar, met.	Electron 2DE1-473
C-0792	Trimmer 9-35pf, right angle	Erie 538-006-9-35pf P.C. type
C-0793	.047uf, 600VDC ±20%	Electron D6-473

DIODES

CR-0078	Type DI-58	Diodes, Inc.
CR-0112	Type 1N758	Transitron P.S.I.
CR-0140	Type 1N702A	P.S.I.
CR-0150	Type CD6262	Continental Devices
CR-0153	Type 1N965	Motorola
CR-0218	Varicap, V27	P.S.I.
CR-0219	Type 1N416B	Sylvania
CR-0227	Type MA458D	Microwave Associates

CONNECTORS

J-0165	BNC w/grd lug	Automatic Metal UG1094/U
J-0308	Min. cable coaxial	Automatic Metal 801B1800

INDUCTORS

L-0019	Choke, 470uf	Nytronics, Wee 470
L-0048	Choke, 2.7 microhenry	Wee-Ductor
L-0067	Choke, 270 microhenry	Stanwyck, Dink 270
L-0068	Choke, 1000 microhenry	Stanwyck, Dink 1000
L-0069	Choke, .15 microhenry	Stanwyck, Dink .15
L-0071	Choke, 1500 microhenry	Delevon, 2500-36

TRANSISTORS

Systron-Donner Part No.	Description	Manufacturer – Part No.
Q-0130	Type 2N706	Philco
Q-0140	Type 2N1711	Raytheon, Fairchild
Q-0152	Type 2N709	Fairchild
Q-0158	Type 2N2708	R.C.A.
Q-0172	Type 2N3440	R.C.A.

RESISTORS

R-0148	Comp. carb. 1.5MΩ, 1/2W, 5%	Allan Bradley EB1555
R-0260	Comp. carb. 1.2K, 1/2W, 5%	Allan Bradley EB1225
R-0264	Comp. carb. 220K, 1/2W, 5%	Allan Bradley EB2245
R-0267	Comp. carb. 22MΩ, 1/2W, 5%	Allan Bradley EB2265
R-0352	Comp. carb. 100K, 1/2W, 5%	Allan Bradley EB1045
R-0358	Comp. carb. 1.2M, 1/2W, 5%	Allan Bradley EB1255
R-0365	Comp. carb. 270Ω, 1/2W, 5%	Allan Bradley EB2715
R-0469	Comp. carb. 470Ω, 1W, 10%	Allan Bradley GB4711
R-0500	Comp. carb. 12K, 2W, 5%	Allan Bradley HB1235
R-0501	Comp. carb. 120Ω, 1/2W, 5%	Allan Bradley EB1215
R-0694	Comp. carb. 270Ω, 1/4W, 5%	Allan Bradley CB2715
R-0696	Comp. carb. 6.8K, 1/4W, 5%	Allan Bradley CB6825
R-0725	Comp. carb. 180Ω, 1/2W, 5%	Allan Bradley EB1815
R-0728	Comp. carb. 15K, 1/4W, 5%	Allan Bradley CB1535
R-0137	Comp. carb. 56K, 1/2W, 5%	Allan Bradley EB5635
R-0741	100K, 1/4W, 5%	Allan Bradley
R-0742	3.3K, 1/4W, 5%	Allan Bradley
R-0743	47Ω, 1/4W, 5%	Allan Bradley
R-0759	Comp. carbon, 12K, 1/4W, 5%	Allan Bradley CB1235
R-0760	Comp. carbon, 22Ω, 1/4W, 5%	Allan Bradley CB2215
R-0765	1K, 1/4W, 5%	Allan Bradley
R-0766	10K, 1/4W, 5%	Allan Bradley
R-0777	47K, 1/4W, 5%	Allan Bradley
R-0780	33K, 1/4W, 5%	Allan Bradley
R-0783	Comp. carbon, 1.5K, 1/4W, 5%	Allan Bradley CB1525
R-0784	82K, 1/4W, 5%	Allan Bradley
R-0819	560Ω, 1/4W, 5%	Allan Bradley
R-0821	5.6K, 1/4W, 5%, comp. carbon	Allan Bradley Type CB
R-0892	4.7K, 1/4W, 5%	Allan Bradley
R-0937	2.7K, 1/4W, 5%, comp. carbon	Allan Bradley
R-0939	3.9K, 1/4W, 5%, comp. carbon	Allan Bradley
R-0959	1.8K, 5%, 1/4W, comp. carbon	Allan Bradley
R-0966	100Ω, 5%, 1/4W, comp. carbon	Allan Bradley Type CB
R-0983	150Ω, 1/4W, 5%	Allan Bradley Type CB
R-1044	470Ω, 1/4W, 5%, comp. carbon	Allan Bradley Type CB
R-1083	560Ω, 1/2W, 5%, carbon comp.	Allan Bradley
R-1213	91Ω, 1/4W, 5%, carbon comp.	Allan Bradley
R-1233	180Ω, 1/4W, 5%	Allan Bradley
R-1234	680Ω, 1/4W, 5%	Allan Bradley
R-1426	68Ω, 1/4W, 5%	Allan Bradley CB6805
R-1461	120Ω, 1/4W, 5%, carbon comp.	Allan Bradley CB1215
R-1546	18Ω, 1/4W, 5%, carbon comp.	Allan Bradley
R-1592	W.W. 1500Ω, 3W, 5%, blue jacket	Sprague 242E1525
R-1674	100Ω, 5W, 5%, type 246-E	Sprague 243E1015
R-1807	270Ω, 1W, ±10%, comp carbon	Allan Bradley GB2715
R-1858	Potentiometer 5K	Spectrol 82-3-8-502
R-1861	Potentiometer 500K, 1/2W, 5%	Bourns 3068P-1-504
R-1863	Potentiometer 500Ω	Spectrol 82-3-8-501

MISCELLANEOUS

H-1187	Heat sink, transistor	I.E.R.C. TXBF 032-0256
Y-0019	Crystal, 1Mc	X-Tron CR-18/U

VIKING LABORATORIES INC

PARTS LIST

CHASSIS ASSEMBLY – MODEL 1292

ASSEMBLIES

Circuit Reference	Description	Systron-Donner Part No.
	Harmonic Preset, P.C. Board Assy.	2-14382
	Time Base ÷3, P.C. Board Assy.	2-14385
	Centering Circuitry	2-14786
	Oscillator Amplifier	2-14870
	Video Amplifier	2-14874
	Mixer Assembly	2-15088

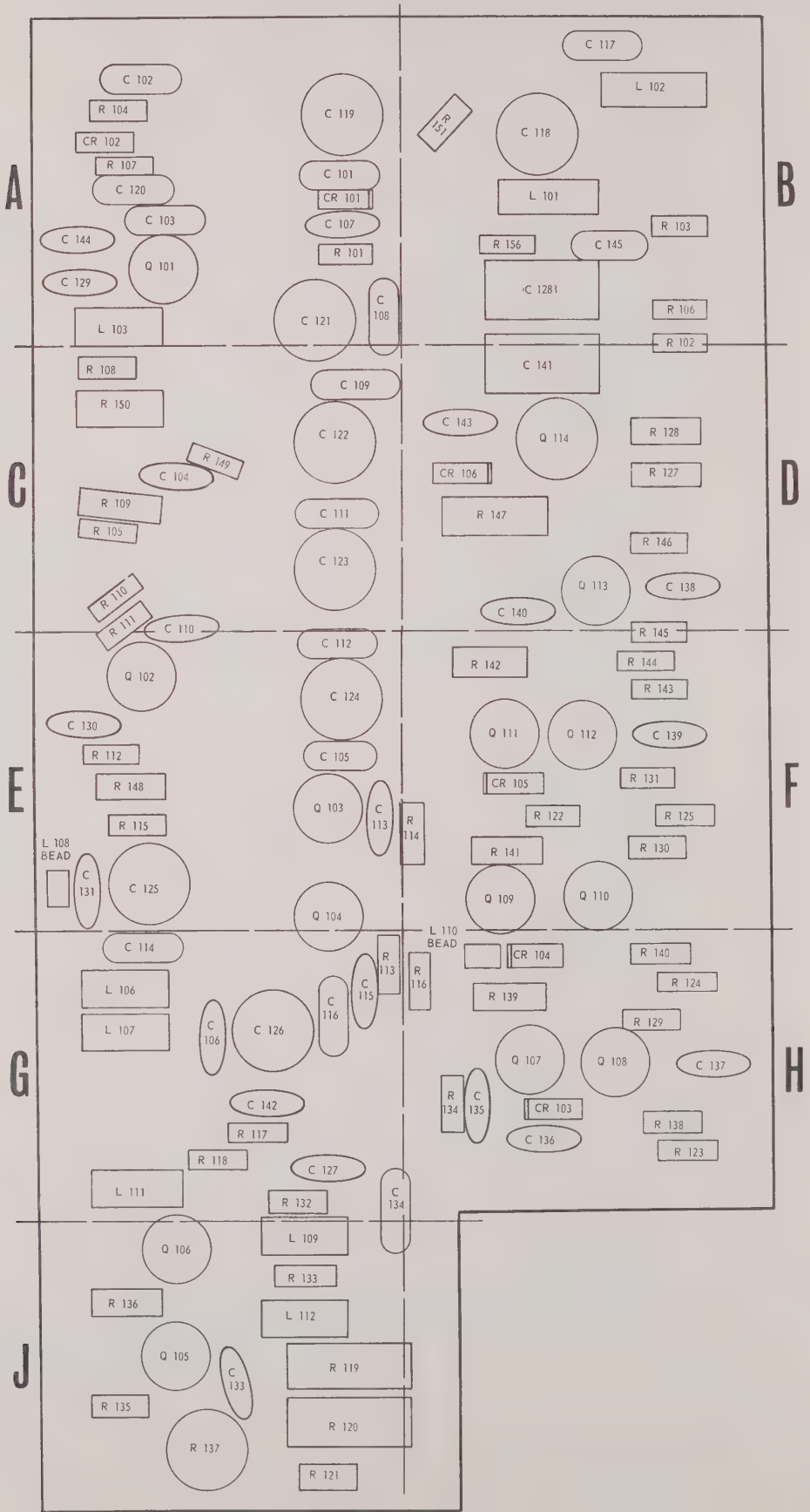
MISCELLANEOUS

	Description	Systron-Donner Part No.
	Dial & Hub Assembly	2-14372
	Shaft, Gear & Dial	1-14373
	Inductuner (modified)	1-15102
J1,J2	Connector, BNC (less nut & washer)	J-0260
	Male Connector	J-0261
R2	Pot, 200k	R-1859
R1	Pot, 10k	R-1860
R3	Pot, 1k	R-1862
S1	Switch, Slide	S-0110
S1 & S2	Switch, Digit	S-0139
	Transformer	T-0096
V1	Tube	V-0107
	Knob, tuning	H-1189
NBD-J-4-3	Reduction Drive	H-1228

VIKING LABORATORIES INC.

PARTS IDENTIFICATION – OSCILLATOR, AMPLIFIER, PRE-SCALER

(Assy. No. 2-14870)



PARTS LIST

OSCILLATOR, AMPLIFIER, PRE-SCALER

ASSEMBLY NO. 2-14870

CAPACITORS

Circuit Reference	Systron-Donner Part No.	Schem. Ref.	Circuit Reference	Systron-Donner Part No.	Schem. Ref.
C101	C-0529	A	C123	C-0712	C
C102	C-0527	A	C124	C-0709	E
C103	C-0529	A	C125	C-0712	E
C104	C-0424	C	C126	C-0709	G
C105	C-0424	E	C127	C-0424	G
C106	C-0424	G	C128	C-0720	B
C107	C-0233	A	C129	C-0424	A
C108	C-0596	A	C130	C-0424	E
C109	C-0596	C	C131	C-0424	F
C110	C-0233	C	C133	C-0424	J
C111	C-0596	C	C134	C-0527	G
C112	C-0596	E	C135	C-0233	H
C113	C-0424	E	C136	C-0233	H
*C115	C-0424	G	C137	C-0233	H
C116	C-0528	G	C138	C-0233	D
C117	C-0535	B	C139	C-0233	F
C118	C-0709	B	C140	C-0233	D
C119	C-0712	A	C141	C-0236	D
C120	C-0529	A	C142	C-0424	G
C121	C-0712	A	C143	C-0233	C
C122	C-0709	C	C144	C-0424	A
*C114	C-0596	G	C145	C-0424	B

DIODES

CR101	CR-0218	A	CR104	CR-0140	H
CR102	CR-0112	A	CR105	CR-0140	F
CR103	CR-0140	H	CR106	CR-0153	D

RESISTORS

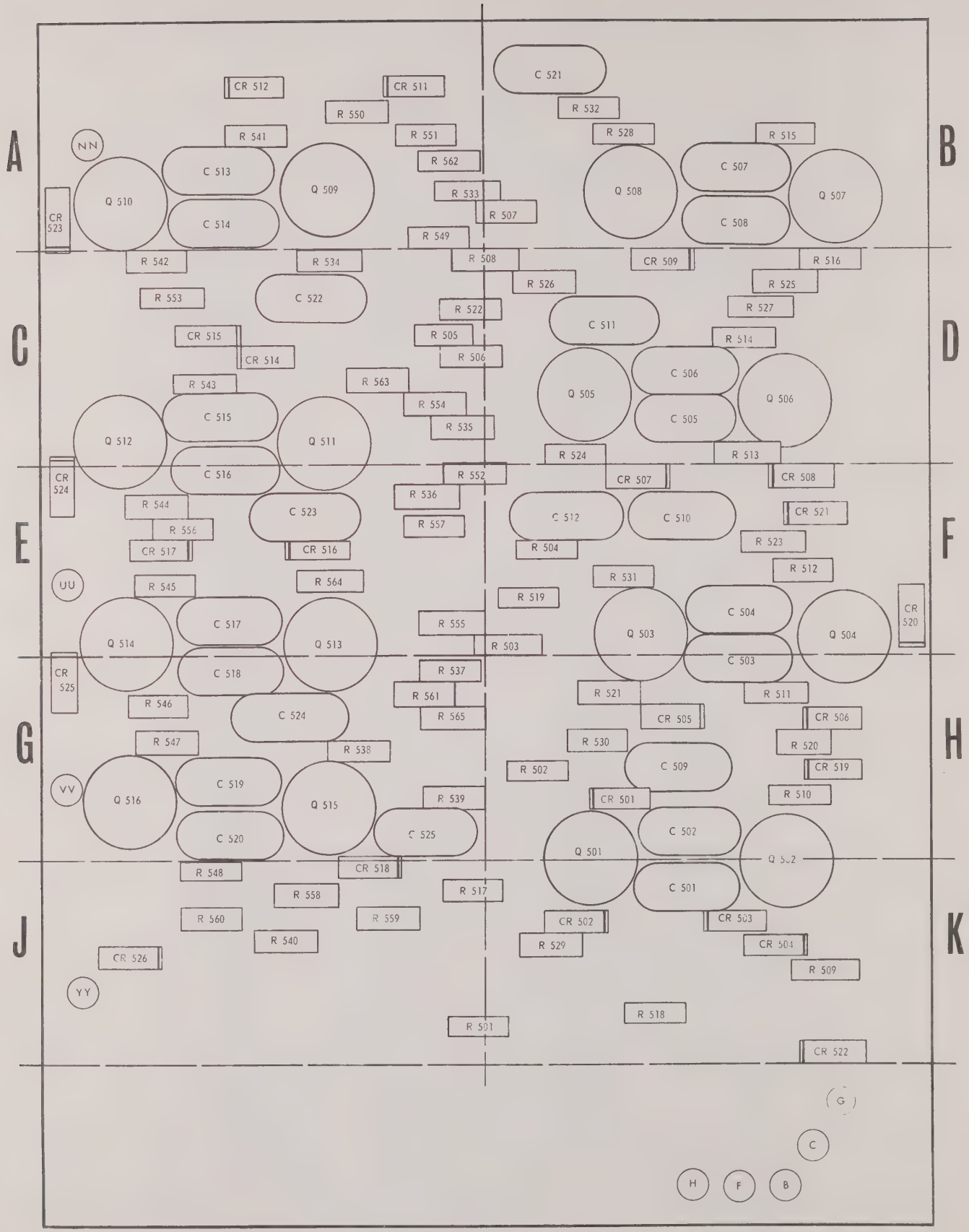
R101	R-0741	R116	R-1044
R102	R-0783	R117	R-0743
R103	R-0766	R118	R-0983
R104	R-0759	R119	R-1807
R105	R-0759	R120	R-1807
R106	R-0983	R121	R-0937
R107	R-0821	R122	R-0760
R108	R-0765	R123	R-1044
R109	R-1083	R124	R-1044
R110	R-0892	R125	R-1044
R111	R-1044	R127	R-0267
R112	R-1426	R128	R-0725
R113	R-0892	R129	R-0760
R114	R-1044	R130	R-0760
R115	R-0766	R131	R-1213
R132	R-1234	R142	R-0267
R133	R-1426	R143	R-1426
R134	R-0819	R144	R-0821
R135	R-1426	R145	R-0892
R136	R-1083	R146	R-0765
R137	R-1863	R147	R-0469
R138	R-0983	R148	R-0501
R139	R-0267	R149	R-0766
R140	R-0983	R150	R-0365
R141	R-0267	R151	R-0766
		R156	R-0766

TRANSISTORS

Q101	Q-0158	A	Q108	Q-0158	H
Q102	Q-0158	E	Q109	Q-0158	F
Q103	Q-0158	E	Q110	Q-0158	F
Q104	Q-0158	E	Q111	Q-0158	F
Q105	Q-0152	J	Q112	Q-0158	F
Q106	Q-0152	J	Q113	Q-0130	D
Q107	Q-0158	H	Q114	Q-0140	D

MISCELLANEOUS

L101	L-0048	B	L109	L-0069	J
L102	L-0067	B	L110	H-0654	F
L103	L-0048	A	L111	L-0048	G
L106	L-0048	G	L112	L-0069	J
L107	L-0048	G	P5	J-0308	
L108	H-0654	E			



PARTS IDENTIFICATION - HARMONIC PRESET
(Assy. No. 14382)

PARTS LIST

HARMONIC PRE-SET

ASSEMBLY NO. 2-14382

CAPACITORS

Circuit Reference	Systron-Donner Stock No.	Schem. Ref.
C501	C-0532	K
C502	C-0532	H
C503	C-0532	H
C504	C-0532	F
C505	C-0532	D
C506	C-0532	D
C507	C-0532	B
C508	C-0532	B
C509	C-0529	H
C510	C-0529	F
C511	C-0539	D
C512	C-0529	F
C513	C-0532	A
C514	C-0532	A
C515	C-0532	C
C516	C-0532	E
C517	C-0532	E
C518	C-0532	G
C519	C-0532	G
C520	C-0532	G
C521	C-0529	B
C522	C-0529	C
C523	C-0529	E
C524	C-0529	G
C525	C-0529	G

DIODES

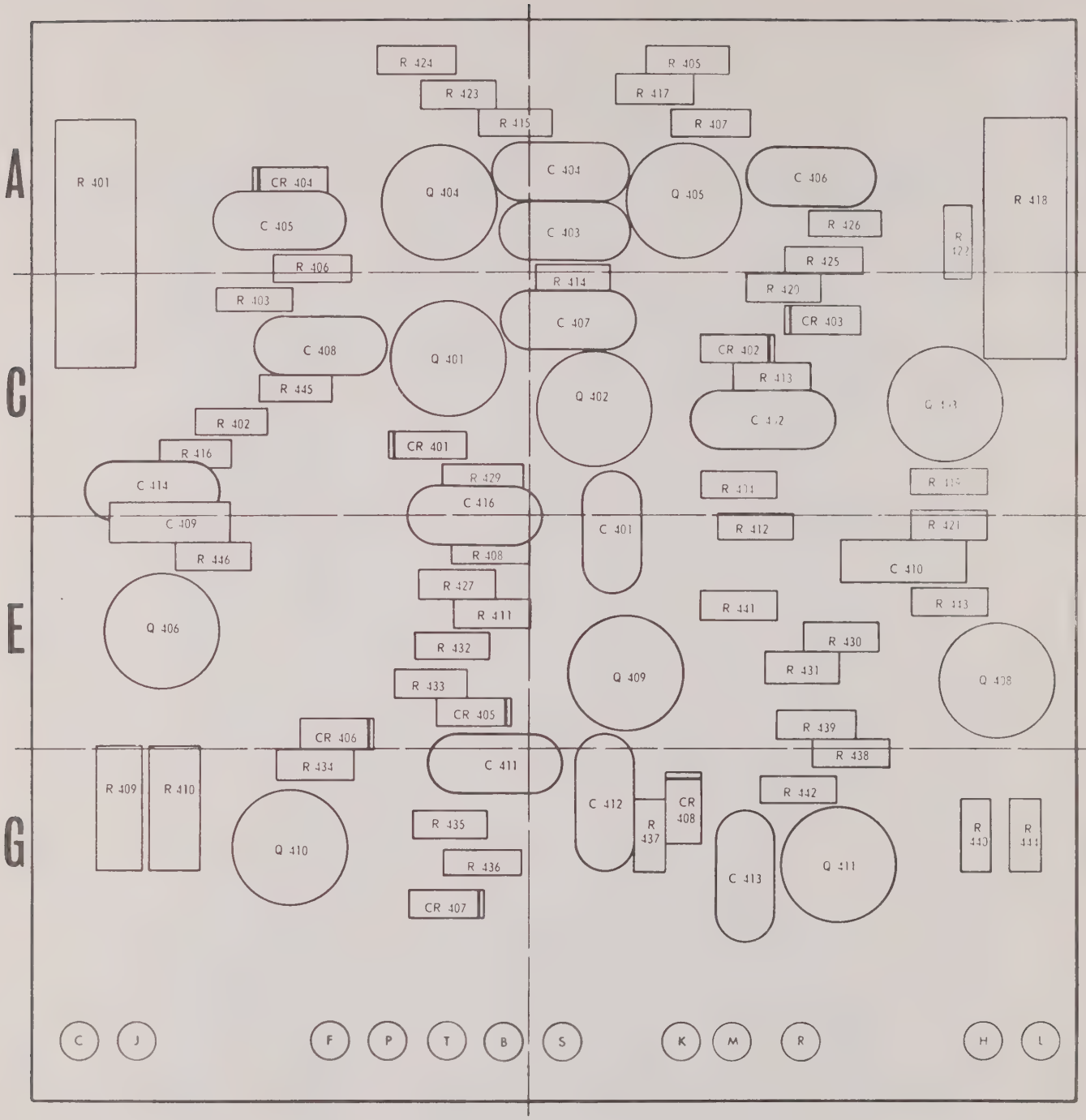
Circuit Reference	Systron-Donner Stock No.	Schem. Ref.
CR501	CR-0150	H
CR502	CR-0150	K
CR503	CR-0150	K
CR504	CR-0150	K
CR505	CR-0150	H
CR506	CR-0150	H
CR507	CR-0150	F
CR508	CR-0150	F
CR509	CR-0150	D
CR511	CR-0150	A
CR512	CR-0150	A
CR514	CR-0150	C
CR515	CR-0150	C
CR516	CR-0150	E
CR517	CR-0150	E
CR518	CR-0150	J
CR519	CR-0150	H
CR520	CR-0150	F
CR521	CR-0150	F
CR522	CR-0150	K
CR523	CR-0150	A
CR524	CR-0150	E
CR525	CR-0150	G
CR526	CR-0150	J

TRANSISTORS

Circuit Reference	Systron-Donner Stock No.	Schem. Ref.
Q501	Q-0130	H
Q502	Q-0130	H
Q503	Q-0130	F
Q504	Q-0130	F
Q505	Q-0130	D
Q506	Q-0130	D
Q507	Q-0130	B
Q508	Q-0130	B
Q509	Q-0130	A
Q510	Q-0130	A
Q511	Q-0130	C
Q512	Q-0130	C
Q513	Q-0130	E
Q514	Q-0130	E
Q515	Q-0130	G
Q516	Q-0130	G

RESISTORS

R501	R-0783	K	R523	R-0696	F	R545	R-0766	E
R502	R-0783	H	R524	R-0784	D	R546	R-0766	G
R503	R-0783	F	R525	R-0696	D	R547	R-0766	G
R504	R-0783	F	R526	R-0784	D	R548	R-0766	J
R505	R-0783	C	R527	R-0696	D	R549	R-0784	A
R506	R-0783	D	R528	R-0784	B	R550	R-0783	A
R507	R-0783	B	R529	R-0766	K	R551	R-0784	A
R508	R-0783	D	R530	R-0766	H	R552	R-0784	F
R509	R-0766	K	R531	R-0766	F	R553	R-0783	C
R510	R-0766	H	R532	R-0766	B	R554	R-0784	C
R511	R-0766	H	R533	R-0783	B	R555	R-0784	E
R512	R-0766	F	R534	R-0783	C	R556	R-0696	E
R513	R-0766	D	R535	R-0783	D	R557	R-0784	E
R514	R-0766	D	R536	R-0783	E	R558	R-0696	J
R515	R-0766	B	R537	R-0783	G	R559	R-0784	J
R516	R-0766	D	R538	R-0783	G	R560	R-0696	J
R517	R-0784	K	R539	R-0783	G	R561	R-0784	G
R518	R-0784	K	R540	R-0783	J	R562	R-0766	A
R519	R-0784	F	R541	R-0766	A	R563	R-0766	C
R520	R-0783	H	R542	R-0766	C	R564	R-0766	E
R521	R-0784	H	R543	R-0766	C	R565	R-0766	G
R522	R-0784	D	R544	R-0766	E			



PARTS IDENTIFICATION - TIME BASE ÷3
(Assy. No. 14385)

PARTS LIST

TIME BASE ÷ 3

ASSEMBLY NO. 2-14385

CAPACITORS

Circuit Reference	Systron-Donner Stock No.	Schem. Ref.	Circuit Reference	Systron-Donner Stock No.	Schem. Ref.
C401	C-0531	F	C408	C-0531	C
C402	C-0531	D	C409	C-0524	E
C403	C-0531	B	C410	C-0524	F
C404	C-0531	B	C411	C-0536	G
C405	C-0528	A	C412	C-0536	H
C406	C-0378	B	C413	C-0424	H
C407	C-0531	D	C414	C-0528	C
			C416	C-0424	C

DIODES

CR401	CR-0150	C	CR405	CR-0150	E
CR402	CR-0150	D	CR406	CR-0150	E
CR403	CR-0150	D	CR407	CR-0150	G
CR404	CR-0150	A	CR408	CR-0150	H

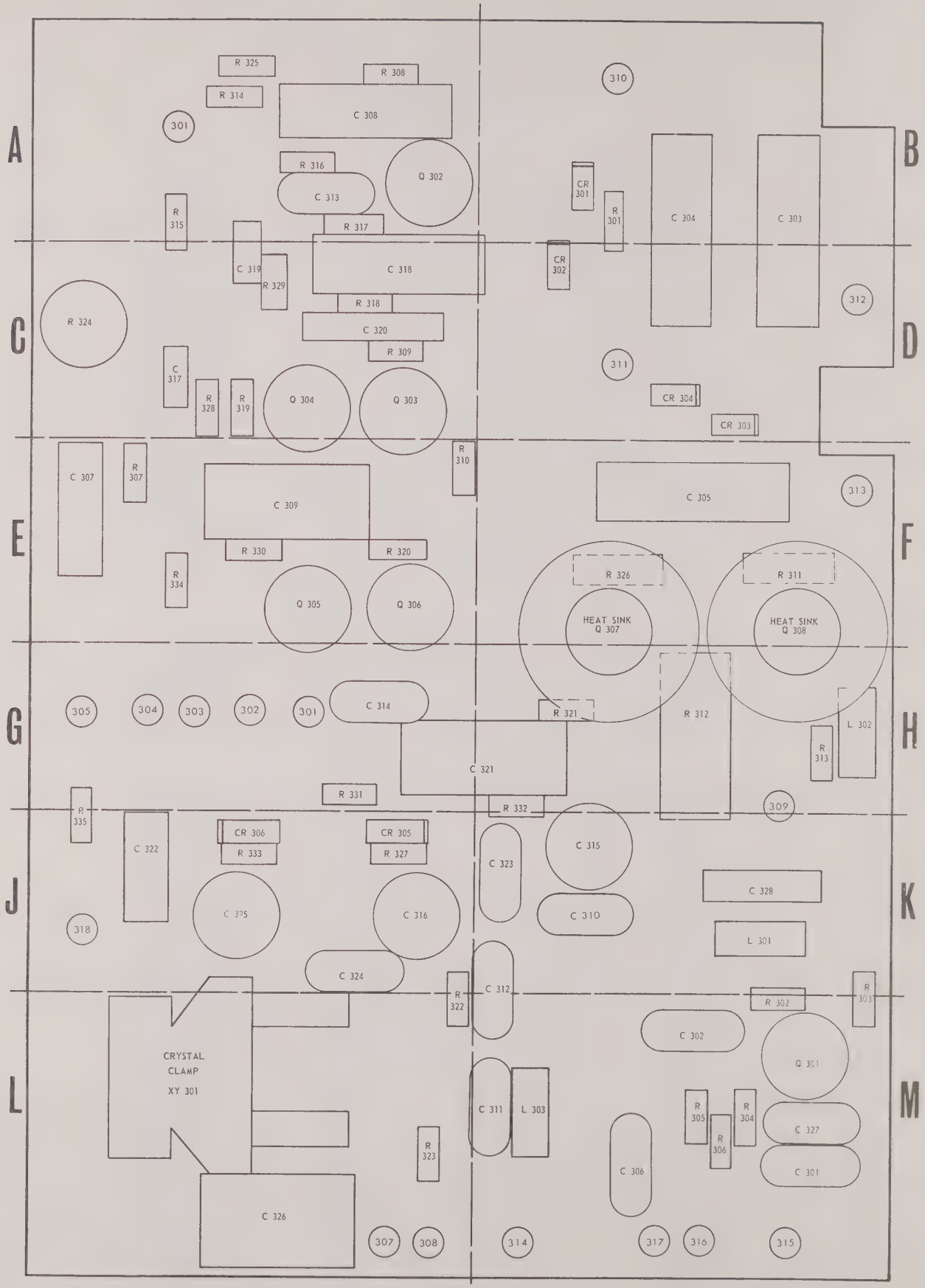
TRANSISTORS

Q-401	Q-0130	C			
Q-402	Q-0130	D	Q-408	Q-0130	F
Q-403	Q-0130	D	Q-409	Q-0130	F
Q-404	Q-0130	A	Q-410	Q-0130	G
Q-405	Q-0130	B	Q-411	Q-0130	H
Q-406	Q-0130	E			

RESISTORS (Note: All resistors are 5%, 1/4W Carbon, unless otherwise noted.)

R401	R-1674	R424	R-0784
R402	R-0728	R425	R-0784
R403	R-0766	R426	R-0766
R404	R-0783	R427	R-0959
R405	R-0783		
R406	R-0783	R429	R-0784
R407	R-0783	R430	R-0728
R408	R-0759	R431	R-0959
R409	R-0260	R432	R-0696
R410	R-0260	R433	R-0783
R411	R-0765	R434	R-0728
R412	R-0766	R435	R-0728
R413	R-0766	R436	R-0765
R414	R-0766	R437	R-0728
R415	R-0766	R438	R-0759
R416	R-0892	R439	R-0728
R417		R440	R-0765
R418	R-1592	R441	R-0821
R419	R-0784	R442	R-0892
R420	R-0783	R443	R-0759
R421	R-0784	R444	R-0777
R422	R-0696	R445	R-0766
R423	R-0783	R446	R-0783

VIKING LABORATORIES INC.



PARTS IDENTIFICATION - VIDEO AMP, DISC. etc.
(Assy. No. 14874)

PARTS LIST

VIDEO AMPLIFIER, DISCRIMINATOR, H. V. POWER SUPPLY, REGULAR, HARMONIC GENERATOR/MIXER

ASSEMBLY NO. 2-14874

CAPACITORS

Circuit Reference	Systron-Donner Stock No.	Schem. Ref.
C301	C-0325	M
C302	C-0425	M
C303	C-0105	B
C304	C-0105	B
C305	C-0105	F
C306	C-0644	M
C307	C-0371	E
C308	C-0365	A
C309	C-0365	E
C310	C-0596	K
C311	C-0425	M
C312	C-0643	K
C313	C-0527	A
C314	C-0562	G
C315	C-0709	K
C316	C-0709	J
C317	C-0524	C
C318	C-0365	C
C319	C-0524	C
C320	C-0788	C
C321	C-0365	H
C322	C-0371	J
C323	C-0533	K
C324	C-0534	J
C325	C-0648	J
C326	C-0399	L
C327	C-0325	M
C328	C-0236	K

DIODES

CR301	CR-0078	B
CR302	CR-0078	D
CR303	CR-0078	D
CR304	CR-0078	D
CR305	CR-0150	J
CR306	CR-0150	J
CR601	CR-0227	Inside mixer
CR602	CR-0219	Inside mixer

COILS

L301	L-0019	K
L302	L-0071	H
L303	L-0067	M

MISCELLANEOUS

XY301	Y-0019	L
P4	J-0308	
J4	J-0165	

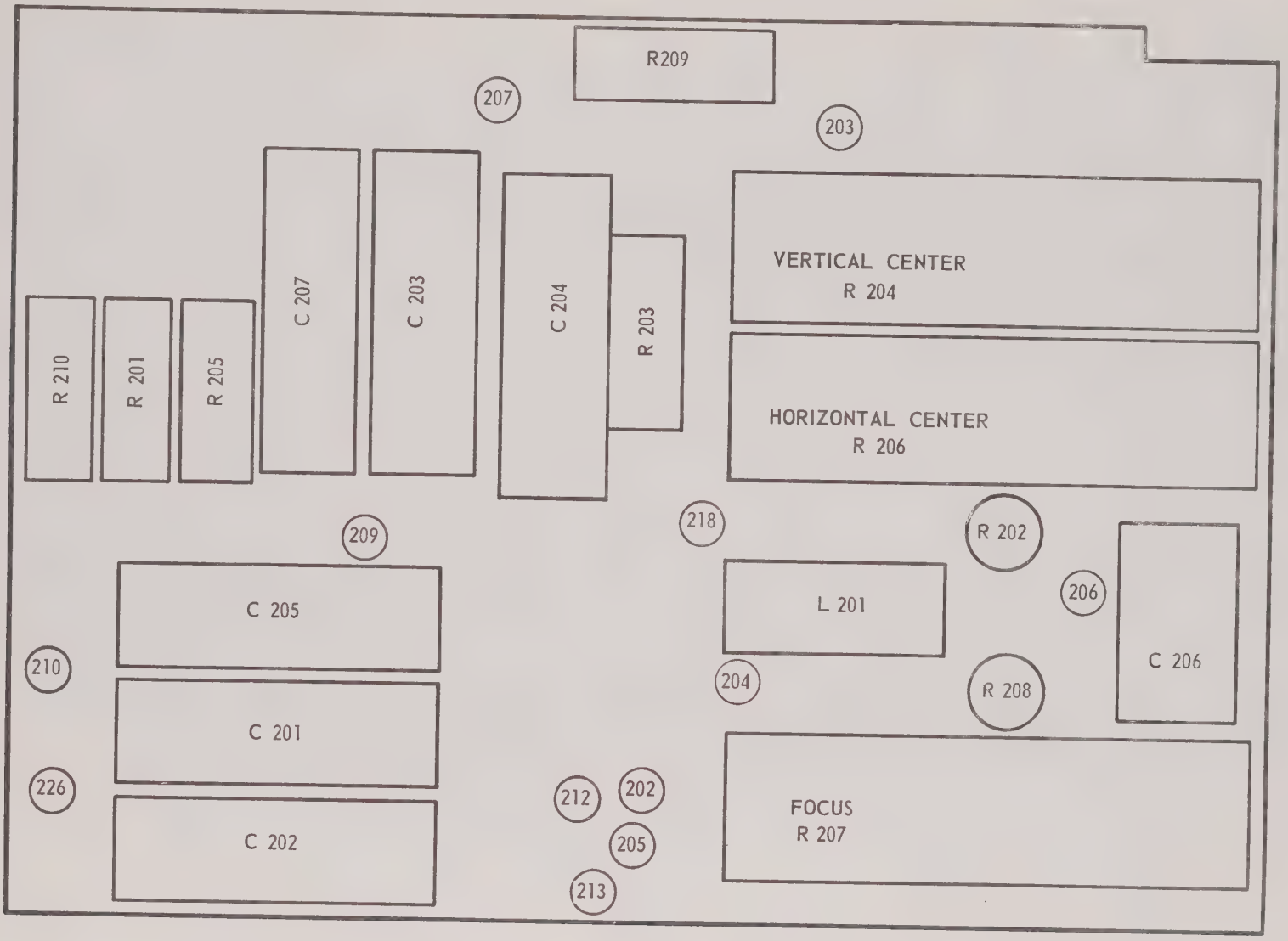
RESISTORS

Circuit Reference	Systron-Donner Stock No.	Schem. Ref.
R301	R-0777	B
R302	R-1233	M
R303	R-0939	M
R304	R-0694	M
R305	R-0892	M
R306	R-0783	M
R307	R-0765	E
R308	R-0696	A
R309	R-0821	C
R310	R-0765	E
R311	R-0137	F
R312	R-0500	H
R313	R-0780	H
R314	R-1044	A
R315	R-0766	A
R316	R-0780	A
R317	R-0892	A
R318	R-1546	C
R319	R-0766	C
R320	R-0892	E
R321	R-1426	H
R322	R-0742	L
R323	R-0766	L
R324	R-1858	C
R325	R-0765	A
R326	R-0137	F
R327	R-0741	J
R328	R-0780	C
R329	R-0966	C
R330	R-0780	E
R331	R-0765	G
R332	R-0819	H
R333	R-0741	J
R334	R-0783	E
R335	R-1461	J

(NOTE: All resistors are 5%, 1/4w carbon, unless otherwise noted.)

TRANSISTORS

Q301	Q-0130	M
Q302	Q-0130	A
Q303	Q-0130	C
Q304	Q-0130	C
Q305	Q-0130	E
Q306	Q-0130	E
Q307	Q-0172	F
Q308	Q-0172	F


R209
207
203
C 207
C 203
C 204
R 203
VERTICAL CENTER
R 204
R 210
R 201
R 205
HORIZONTAL CENTER
R 206
218
R 202
209
C 205
L 201
206
C 206
210
204
R 208
C 201
226
212
202
FOCUS
R 207
C 202
205
213

PARTS LIST

ASSEMBLY CENTERING CIRCUITRY
ASSEMBLY NO. 2-14876

CAPACITORS

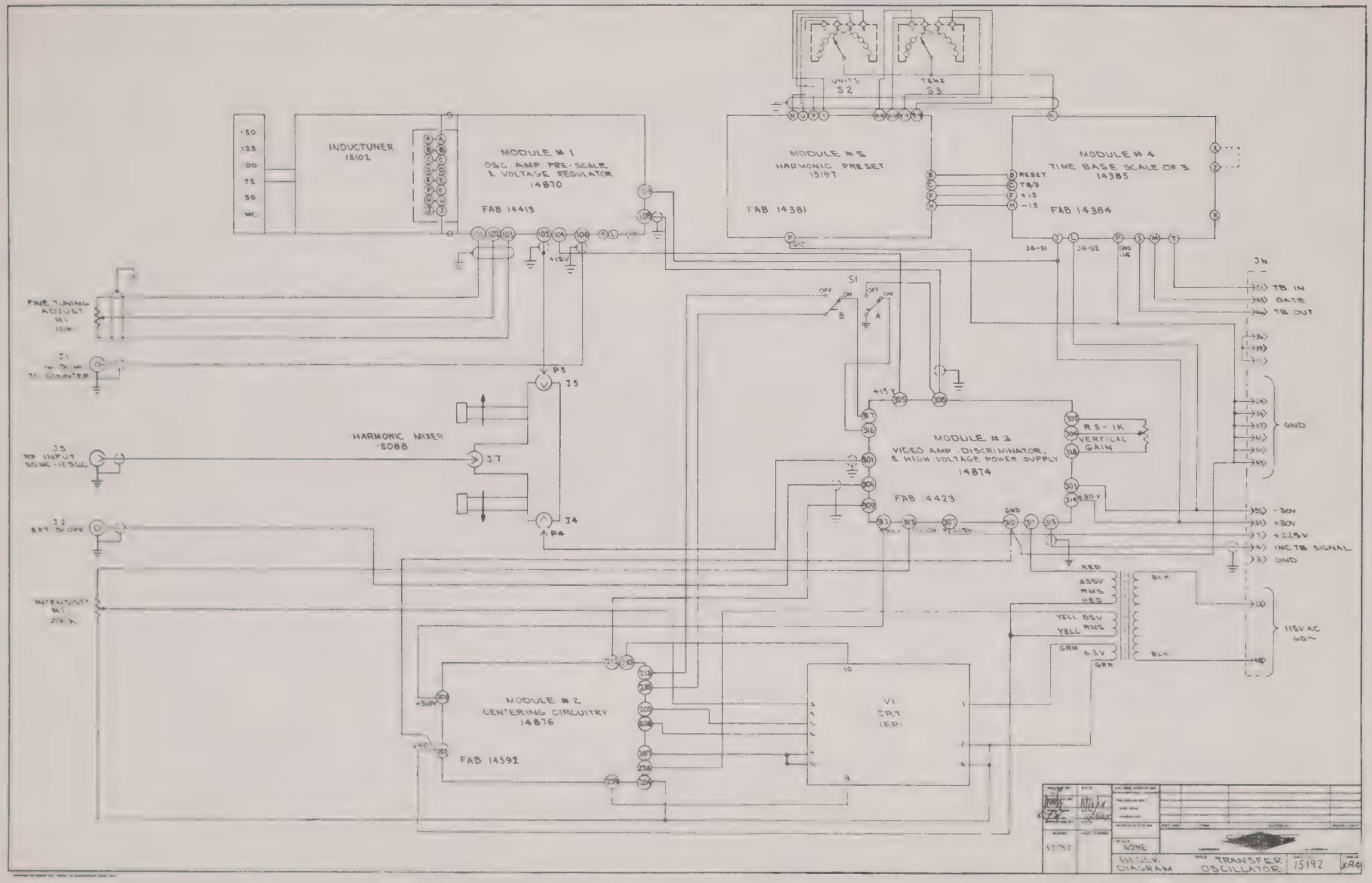
Circuit Reference	Systron-Donner Stock No.	Circuit Reference	Systron-Donner Stock No.
C201	C-0793	C205	C-0793
C202	C-0793	C206	C-0792
C203	C-0793	C207	C-0793
C204	C-0793		

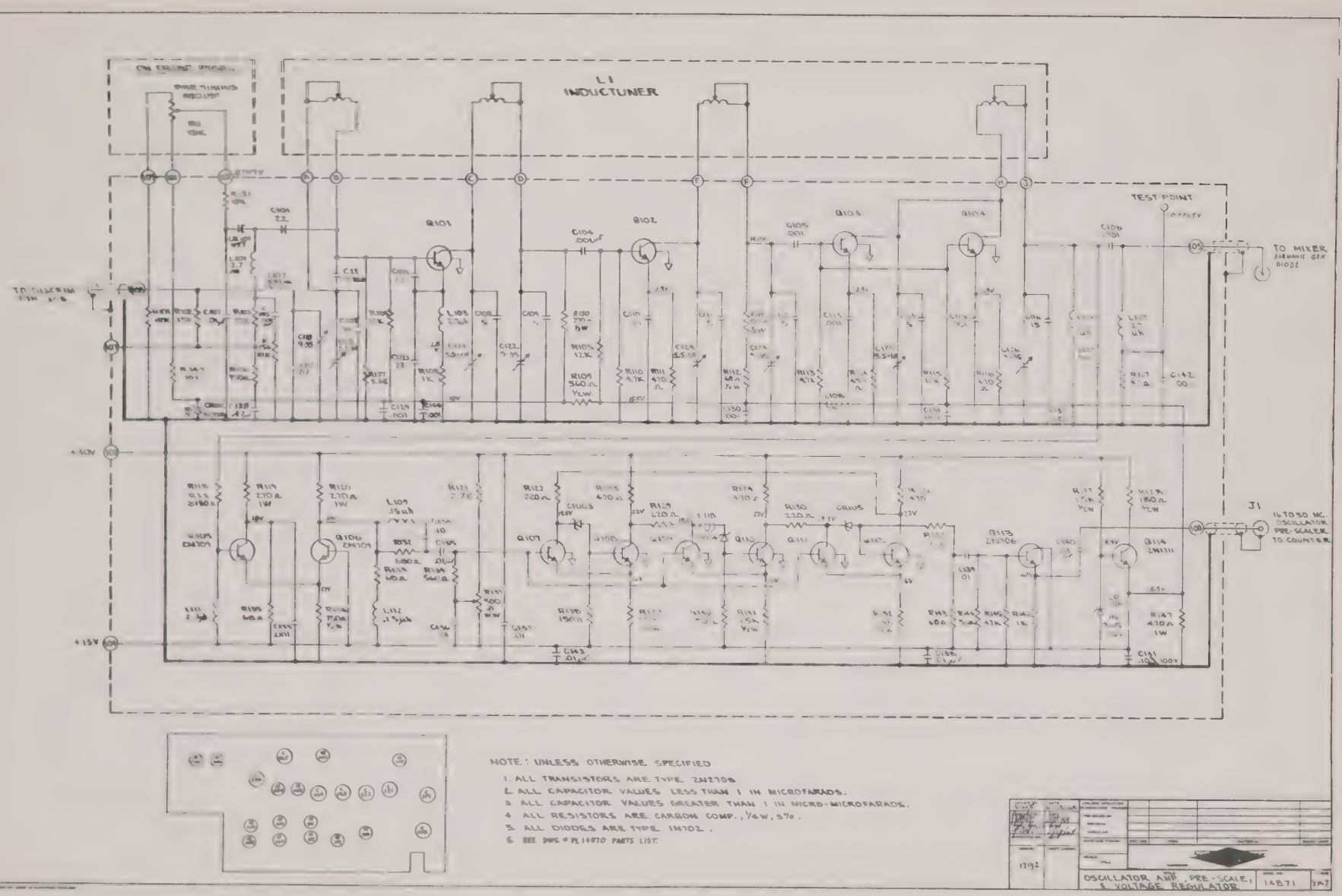
RESISTORS

R201	R-0148	R206	R-1861
R202	R-0148	R207	R-1861
R203	R-0358	R208	R-0264
R204	R-1861	R209	R-0352
R205	R-0352	R210	R-0148

MISCELLANEOUS

L201	L-0068


INDUCTUNER
15102
MODULE # 1
OSC. AMP PRE-SCALE
& VOLTAGE REGULATOR
14870
FAB 14413
MODULE # 5
HARMONIC PRESET
15197
FAB 14381
MODULE # 4
TIME BASE SCALE OF 3
14385
FAB 14384
UNITS
S2
TENS
S3
S1
FINE TUNING
ADJUST
R1
10K
J1
RF INPUT
TO GUNNER
J3
RF INPUT
30 MC - 12.5 GC
J2
EXT TRIG IPT
INTENSITY
R1
20K
HARMONIC MIXER
5088
J7
J4
P4
P3
J5
MODULE # 3
VIDEO AMP, DISCRIMINATOR,
& HIGH VOLTAGE POWER SUPPLY
14874
FAB 4423
R8 - 1K
VERTICAL
GAIN
MODULE # 2
CENTERING CIRCUITRY
14876
FAB 14592
V1
CRT
1FP1
J6
TB IN
GATE
TB OUT
GND
-30V
+80V
+225V
INC TB SIGNAL
GND
115V AC
60~
6.3V RMS RED
YELL 6.3V RMS
GRN 6.3V
RED
BLK
YELL
GRN
BLK
TRANSFER OSCILLATOR
15192
SCHEMATIC DIAGRAM
NONE


L1
INDUCTUNER
TEST POINT
TO MIXER
HARMONIC GEN
DIODE
J1
1670-30 MC.
OSCILLATOR
PRE-SCALER
TO COUNTER
+10V
+15V
Q101
Q102
Q103
Q104
Q106
Q107
Q110
Q111
Q113
Q114
Q115
Q116
Q117
Q118
Q119
Q120
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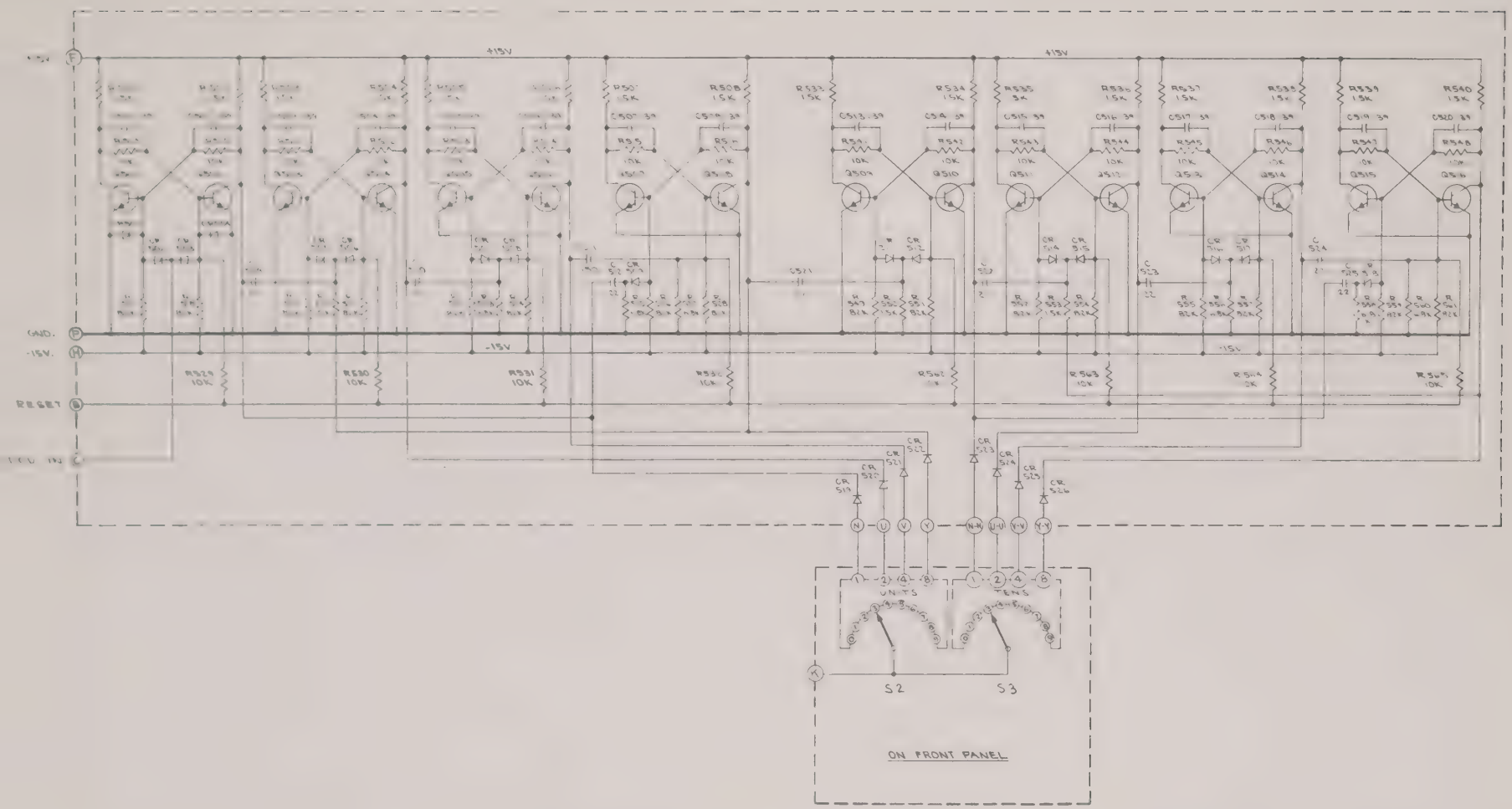
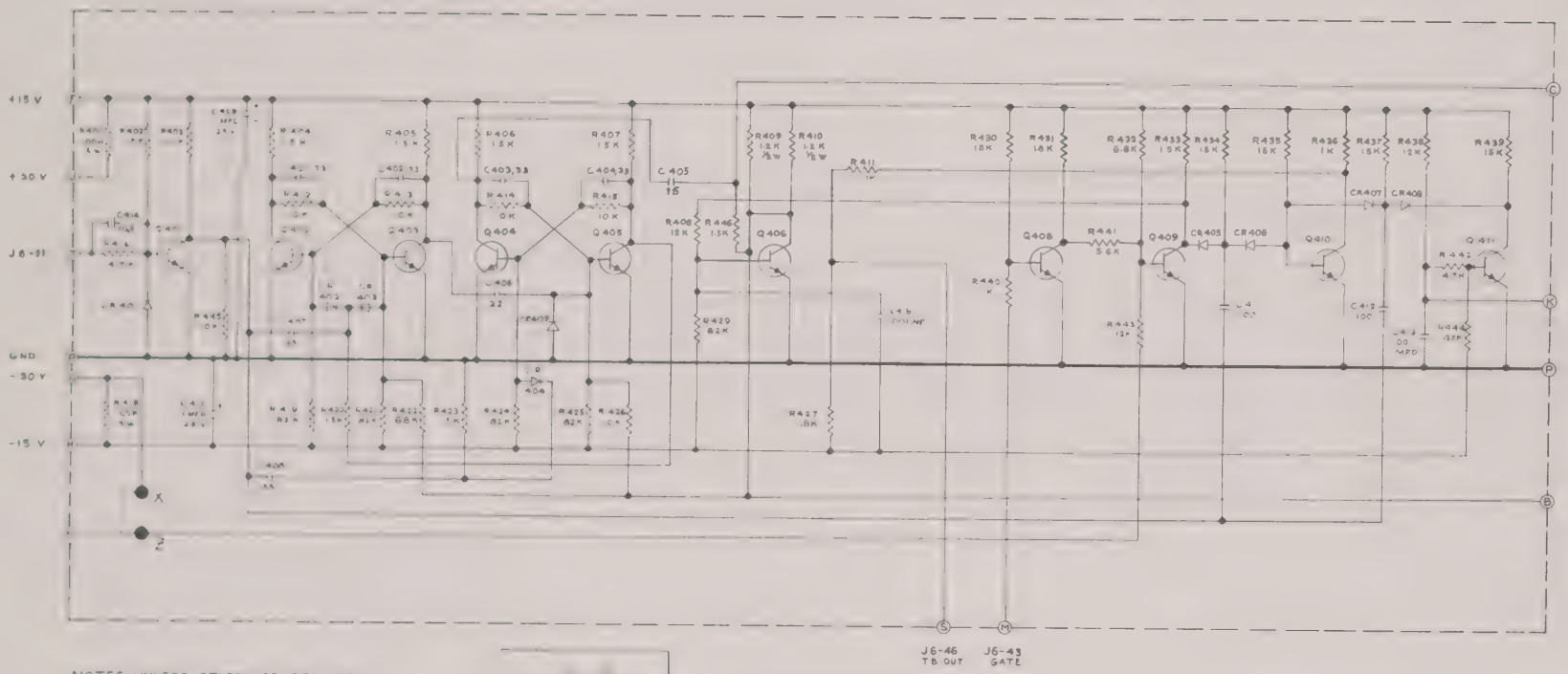
Q147
Q148
Q149
Q150
Q151
Q152



NOTE: UNLESS OTHERWISE SPECIFIED

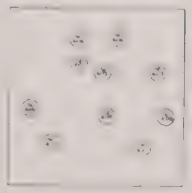
1. ALL TRANSISTORS ARE TYPE 2N706.
2. ALL CAPACITOR VALUES LESS THAN 1 IN MICROFARADS.
3. ALL CAPACITOR VALUES GREATER THAN 1 IN MICRO-MICROFARADS.
4. ALL RESISTORS ARE CARBON COMP ½W, 5%
5. ALL DIODES ARE TYPE CD6262.

Schematic Diagram(Model 129
HARMONIC PRESET
Dwg. 14872-XP3

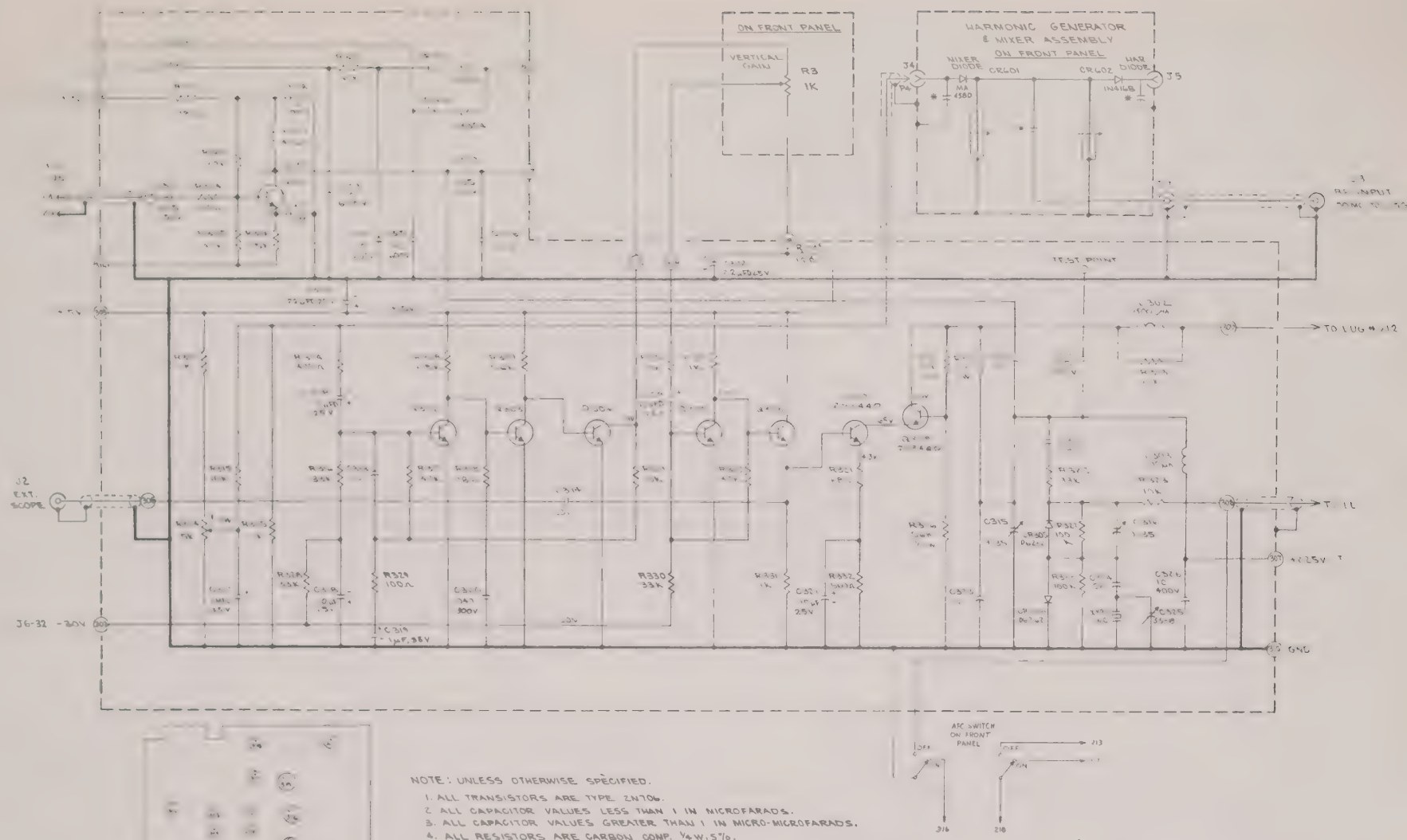


NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL TRANSISTORS ARE TYPE 2N706
2. ALL CAPACITOR VALUES IN MICRO-MICROFARADS
3. ALL RESISTORS ARE CARBON COMP ¼W, 5%
4. ALL DIODES ARE TYPE CD6262



1252	4385	TIME BASE SCALE OF 3	1437



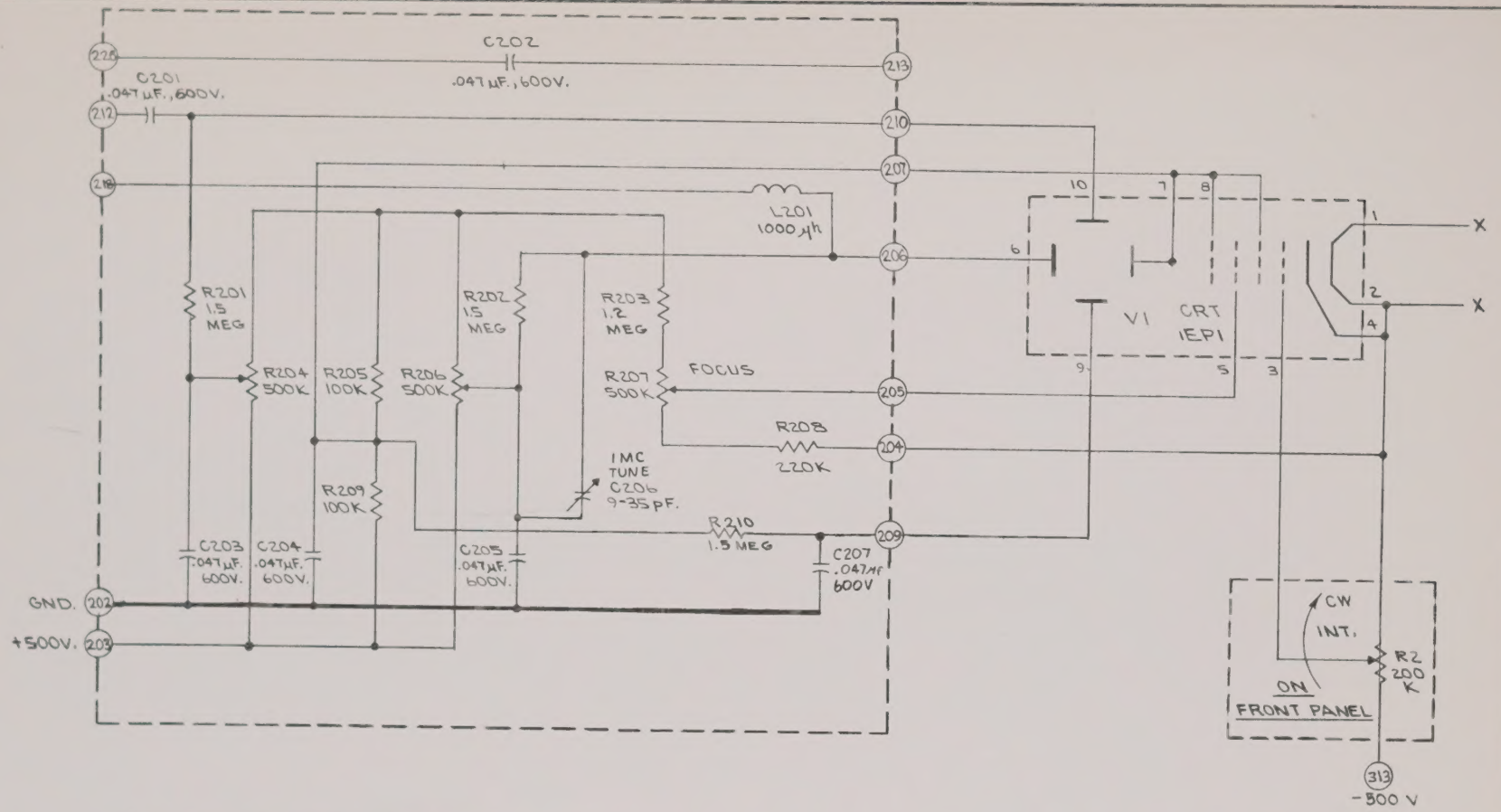
NOTE: UNLESS OTHERWISE SPECIFIED.

1. ALL TRANSISTORS ARE TYPE 2N706.
2. ALL CAPACITOR VALUES LESS THAN 1 IN MICROFARADS.
3. ALL CAPACITOR VALUES GREATER THAN 1 IN MICRO-MICROFARADS.
4. ALL RESISTORS ARE CARBON COMP. ¼W, 5%.
5. ALL DIODES ARE TYPE D1SB.
6. * INDICATES PART OF MIXER ASSEMBLY.

Schematic Diagram – Model 1292

VIDEO AMPLIFIER, DISCRIMINATOR, H. V. POWER SUPPLY, REGULATOR and HARMONIC GENERATOR/MIXER

Dwg. No. 14875-XP8



NOTE: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE CARBON COMP. 1/2W, 5%.

ITEM NO.	QTY	PART NUMBER	DESCRIPTION	SCHEMATIC REF. NO.

LIST OF MATERIALS

DRAWN EHE 6-22-64	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMAL TOLERANCE .X .XX .XXX ANGLES ±	SYSTRON DONNER CORPORATION CONCORD, CALIFORNIA	CENTERING CIRCUITRY
CHECK			
ENGR			
MFG			
PROJECT 2 SV 11-17-64			
APPROVAL		MATERIAL ~	DWG NO. 14877 ISSUE XP-5
USED ON 1392	NEXT ASSY	SCALE ~	DO NOT SCALE DRAWING
APPLICATION		DWG SIZE C	SH 1 OF 1